METAL SHOW ISSUE

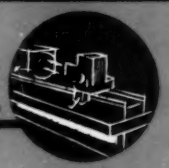
NOVEMBER 1959

Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

UNIVERSITY MICROFILMS
313 N 1ST ST
ANN ARBOR MICH WIR

AUTOMOTIVE



MACHINE TOOL

STRUCTURAL

Case studies from 7 industries show...

WHAT MAKES GOOD DESIGN

PRESSURE VESSEL

AIRCRAFT

ELECTRICAL

SHIP BUILDING

INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

The magazine of welding management, production, and engineering

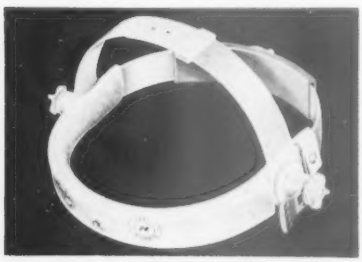
QUALITY JACKSON PRODUCTS ®

Vinylfoam Sweatbands

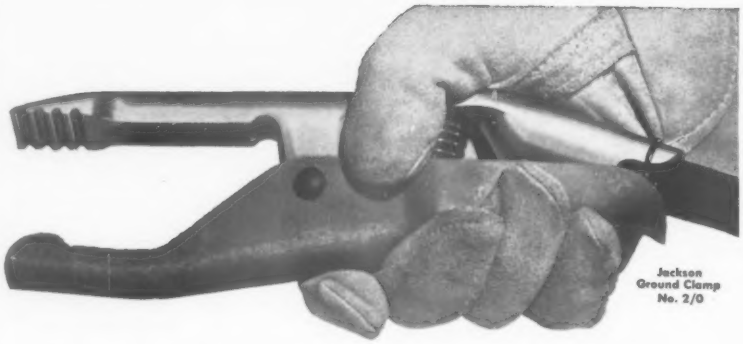
Offering the utmost in comfort and highly moisture absorbent, these new sweatbands are now furnished, at no extra cost, as part of the plastic headrests of Jackson goggles and of the type J-1 face shield. They hold the headrest more firmly on the head and will keep their bright, clean appearance by being easy to clean or sterilize. As replacement parts they fit all Jackson headrest goggles and J-1 face shields now in use.

Goggles W-70, W-60 and W-50 have plastic headrest with telescopic arms for firmer fit, easier positioning. Now more comfortable than ever with new sweatband, part 41.

Popular face shield type J-1 with wide choice of visors in clear and in shades of green. New vinylfoam sweatband, part 27, fits the headrest of type J-1 and goggles BX.



New Vinylfoam sweatband part 74 is offered as an optional part on the Adjust-O-Lok headgear of Jackson welding helmets and the Musketeer face shield. Quickly fastened with snap buttons, it makes this unequalled headgear even more comfortable and fit more firmly.



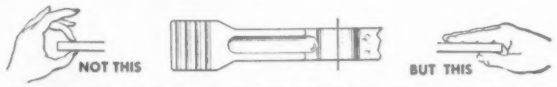
Jackson Ground Clamp No. 2/0

Good Grounds for Welding Profits

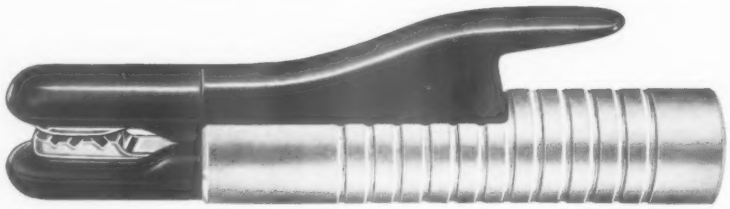
Jackson Ground Clamps

Are current leaks eating up your welding profits? Jackson Ground Clamps provide ample flow of current, stop power losses. Simple, rugged design has copper alloy upper tong for broad metal-to-metal contact, lower tong for pressure.

Shaped to fit the hand, the tongs open wide, go *on* and *off* easier. Strain on cable is reduced by angle of socket, to which cable may be wired. Insulation between tongs prevents accidental arcing. Ground Clamps (as well as Cable Connectors, Splicers and Lugs) are made to fit cables from No. 4 through 4/0.



Large contact area of upper tong provides greatest conductivity



New Arc Welding Electrode Holder

Jackson Model JH-1

This small, lightweight copper alloy holder of streamlined design is a well constructed quality tool at a low price. It is a safe, well insulated electrode holder for general use within its rated capacity, and an ideal unit for farm welding, shop maintenance and repair work.

The cable may be mechanically clamped, brazed, or soldered as in all other famous Jackson holders with copper alloy tongs. Jaw insulators and lever are of high-compression molded plastic of excellent quality, yet are inexpensive to replace.

Model JH-1 • Electrodes through 5/32" • 150 Amps • 8" long • 12 oz.

Sold World-Wide through Distributors and Dealers

Jackson Products

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31739 Mound Road, Warren, Michigan

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Circle No. 42 on Reader Service Card. →

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* The choice of leading metalworking industries EVERYWHERE

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DC Models offer big production SAVINGS

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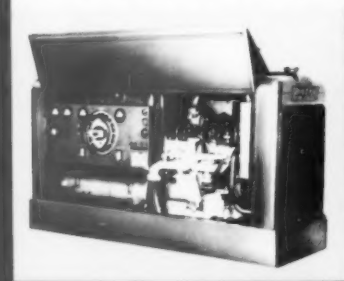
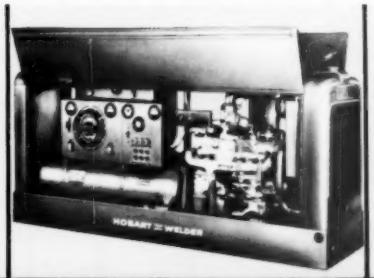
and remote controls

GASOLINE AND DIESEL MODELS
for fast, low cost "In-The-Field" Welding

IT IS BETTER TO HAVE BOUGHT HOBART THAN TO WISH YOU HAD



Welds, runs tools simultaneously
300 AMP. DC WELDER—3KW DC POWER



For work demanding 12 KW AC Power plus a 400 AMP. DC WELDER

5 KW 60 cycle AC Power PLUS DC Welder 200 AMP. "POWER/WELD"

EXCEPTIONAL ARC STABILITY—
Very simple to operate

COMBINATION DC WELD-AC POWER
models take over in case of power failures

CUTS WELDING COSTS—MEETS COMPETITION—SAVES YOU $$$$$

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300, 400, 500 amp. models
AC INDUSTRIAL TRANSFORMERS

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ALL TYPES of AC or DC TRANSFORMER WELDERS

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Fully Automatic — Eliminates Plumbing Saves $$ on Installation Costs

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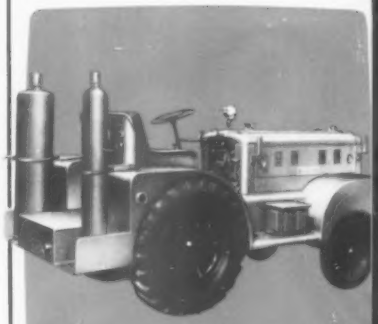
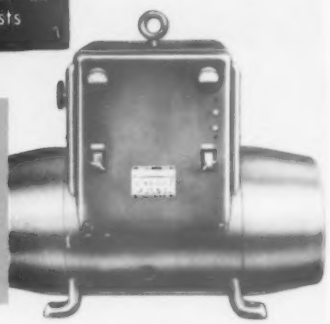


For cutting "Down Time"–"Labor Losses" 400, 600 Amp. DC **"BIG WHEELER"**

SIMPLIFIED CV AUTOMATIC WELDING
speeds production without adding manpower



For automatic, semi-automatic welding **CONSTANT VOLTAGE POWER SOURCE**

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For inert gas shielded arc welding **"MIGARC"**

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INERT GAS WELDING HEADS
FULLY AUTOMATIC CO_2 WELDING HEADS
TUNGSTEN ARC FULLY AUTOMATIC HEAD

AUTOMATIC WELDING HEADS

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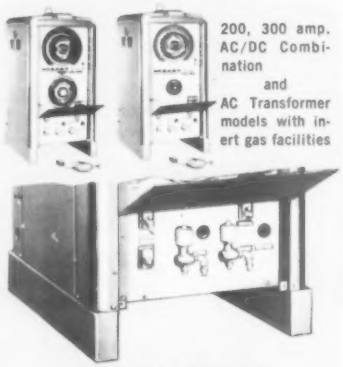

INERT GAS FACILITIES

"TIGPAK" lets you do inert gas welding in the field. Use it with Hobart engine drive welders that have AC power. (Or any DC model provided 110 V. power is available to run high frequency and water pump.)

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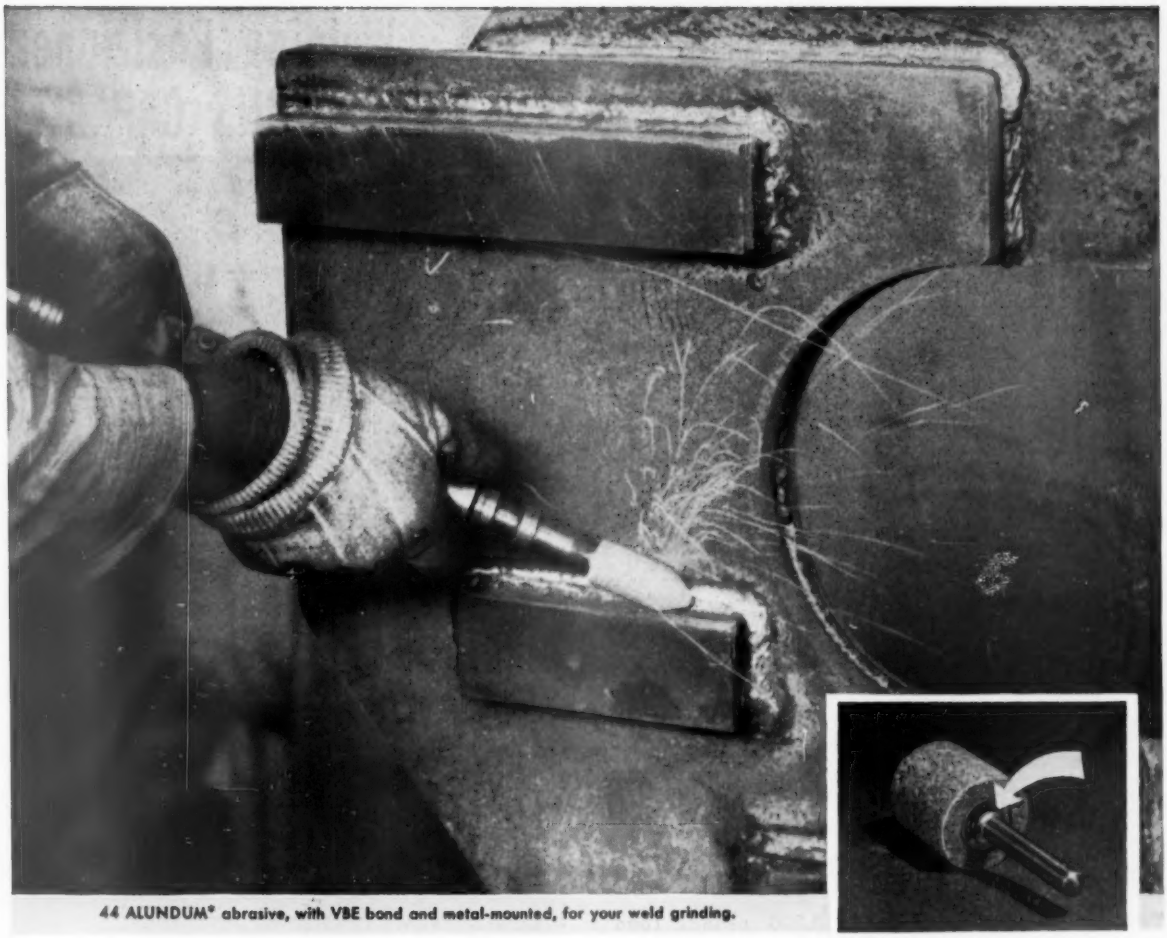
ELECTRODES • WIRE • FLUX

Reported savings up to 40% on Hobarts' new H-900 Pelletized Flux for use with hard surfacing welding wires. The "Self-Peeling" characteristics of this Flux are particularly appealing.

Hobart Autoflux H-100 is also a new development answering todays demands for lower production cost. An excellent Flux for single pass butt and lap weld.



44 ALUNDUM* abrasive, with VBE bond and metal-mounted, for your weld grinding.

Here's how Norton keeps

"Making better products to make your products better"

In weld grinding, as throughout their entire job range, Norton mounted wheels are hitting new highs in grinding efficiency.

Outstanding new developments in abrasives and wheel construction eliminate loading and glazing — besides giving you the fastest cutting rate, with a marked increase of stock removed per wheel.

These advantages are the natural results of Norton Company's long experience in engineering mounted wheels for best performance in every application—from tool and die finishing to all kinds of rough grinding.

For weldments and steel castings, mounted wheels of 44 ALUNDUM abrasive, with VBE bond and metal-mounted, are unequalled. "44" grinds better than other non-premium priced abrasives because it's made differently, for extreme toughness. And the VBE vitrified bond assures the ideal structure for mounted wheel weld grinding.

METAL-MOUNTING — Another Norton Exclusive — You throw nothing away but the mandrel!

Norton does it again! . . . The mounted wheels are so securely anchored to the mandrel — *you use all of the abrasive!* No waste . . . all work! This radically improved method of locking the abrasive body to the mandrel is used on mounted wheels in most sizes and shapes, 5/16" diameter and larger. Molten metal, injected into the abrasive recess at high pressure, does it — and does it fine!

Every Norton mounted wheel is accurately trued *after mounting* on rust-proof stainless steel mandrels. Developed to increase the time-and-money-saving "Touch of Gold", Norton mounted wheels are stocked in approximately 200 standard shapes and sizes. See your Norton Distributor for prompt deliveries.

Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

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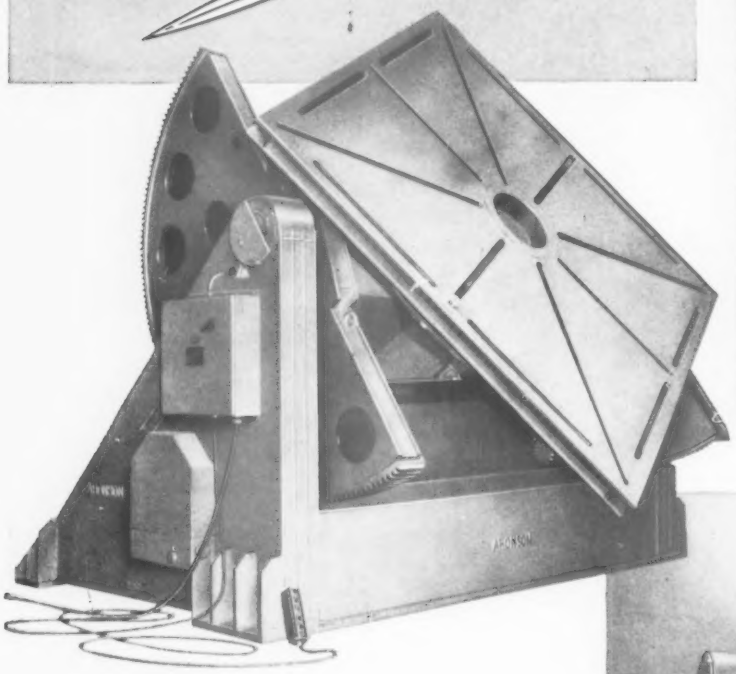
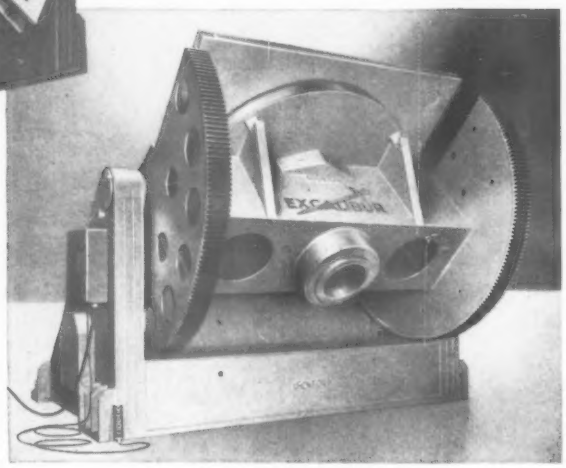
EXCALIBUR.....

Welding Positioner 175 TONS CAPACITY





"EXCALIBUR" is rated 350,000 pounds Load Capacity with CG 12" above table and 6" off-center.

FOUR SELECTIVE VARIABLE SPEED RANGES obtained from the 4-speed gearshift transmission driven by 15 hp Varidrive afford far greater choice of variable rotation speeds. In High Gear top speed is .4 rpm adjustable to .07 rpm. This exceptionally high rotation speed permits automatic welding at high travel rate on diameters as small as eight inches! Then, for larger diameters shift into 3rd Gear and use the .23 rpm to .04 rpm range. Or, still larger work may require 2nd Gear's .13 rpm to .023 rpm range. Largest weldments are profitably rotated in Low Gear range's .08 rpm to .013 rpm.

"EXCALIBUR" is not physically tremendous, being only 88" from floor to horizontal rotation axis, which allows working both large and small weldments without needing excessive headroom and without working too high above the floor.

"EXCALIBUR" has been designed to handle almost every kind of weldment at lowest possible shop cost.

Owning "EXCALIBUR" opens production doors to you that are closed to your competitors. It is NOT a special job machine, but a Welding Positioner that will handle 90% of your jobs that are as small as a ton or so to as large as 175 tons!

Owning **"EXCALIBUR"** lets you weld automatically those jobs you now wrestle around the shop floor with the profit-eating crane and have to weld manually.

With **"EXCALIBUR"** in your list of machine tool facilities you not only can underbid competition but can assure the award of the contract because your customer will know you have the facility to handle his work.

Quality POSITIONERS by **Aronson MACHINE COMPANY**

ARCADE, NEW YORK

WELDING POSITIONERS • TANK TURNING ROLLS • TURNTABLES

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reader's guide to ® *for November, 1959*

COVER: Today the welding industry must make two weldments grow where one grew before. In addition to the welding engineering and fabricating plant group, it must now reach the design group who decides that a product shall be welded—or bolted or forged or cast or riveted. Design men must be taught to weld products they never before thought could be or should be welded.

FEATURES

41 CASE STUDIES FROM 7 INDUSTRIES SHOW WHAT MAKES GOOD DESIGN

42 UNITIZED DESIGN MAKES FORD'S FALCONS STRONGER
Welded design and good fabricating and welding techniques are combined to make a strong, high quality economy car.

44 DODGE PRE-TESTS WELDED CAR BODIES ON PLASTIC SCALE MODEL
Dodge makes nondestructive tests on a plastic model and gets the same answers that destructive testing gives on a full-sized welded steel model body.

49 REDESIGN CUTS WELDMENT COST IN HALF
Members of Brown & Sharpe's engineering, fabricating and design departments team up to eliminate straightening and grinding operations.

50 STANDARD STRUCTURAL SHAPES SIMPLIFY MACHINE BASE DESIGN
Rigid sections can be made economically by welding various combinations of channels, I-beams, H-columns, angles, tubes and plates.

52 WELDED-STEEL DESIGN MAKES LATHE STRONGER, LIGHTER, CHEAPER
New lathe represents first use of welded design for a line of standard planned-for-production engine lathes.

54 PRACTICAL HINTS ON DESIGNING AND ORDERING PRESSURE VESSELS
The designer and fabricator of a pressure vessel must know how it is to be used, what chemical will be used in it and the rate of corrosion.

56 SAVANNAH'S NUCLEAR POWER PLANT IS HOUSED IN A WELDMENT
A 500,000-lb. steel shell houses the Savannah's entire reactor plant and the primary cooling system.

58 SPOT WELDED PAPER-THIN STEEL WITHSTANDS 305,000 PSI
Foil-thin stainless strips contain rocket motor's explosive forces.

60 REDESIGNED TRANSFORMER CASE CALLS FOR WELDED ALUMINUM
Welded aluminum is light, non-leaking, cooler and needs less maintenance.

63 SIMPLIFIED DESIGN CUTS COST OF SECOND GEODESIC DOME
All-welded steel structure is 380-feet in diameter, 120-feet high, has no hindering internal supports and covers a floor area of 110,000 square feet.

66 HOW TO SELL DESIGNERS AND ENGINEERS ON STRUCTURAL WELDING
Explain welding's economy, the fabricator's capacity and how quality is controlled.

69 REDESIGN FOR FURNACE BRAZING CUTS COST 80 PERCENT
Stainless turbine rotor assembly used to be machined from a solid forging.

70 QUALITY CONTROL OF WELDED STEEL TUBING
Quality control system controls every step in production of tubing. Result is strong, uniform, easy-to-work and cheaper tubing.

73 GMC USES STATISTICAL METHODS TO IMPROVE PROJECTION WELDING
Plotting tensile tests gives a more positive check on weld quality.

76 WELDED BASE ABSORBS A HALF-MILLION POUND SQUEEZE
Production units withstand pressures used to shape and cure tires.

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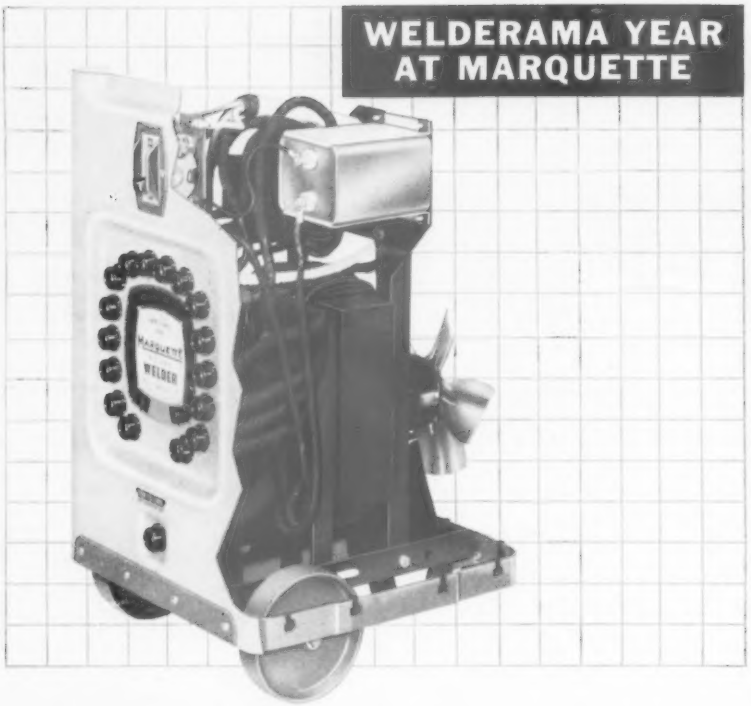
WELDERAMA YEAR AT MARQUETTE



Looking into a new welder

The new MARQUETTE Series 94 A.C. Arc Welder combines the most modern engineering features with a super heavy duty transformer, providing these important benefits:

- Perma-Shield Fibre-Glass cabinet construction. This efficient, lightweight design eliminates "eddy current" losses; too, it's noiseless, rustproof and weatherproof.
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- Internally fused capacitor that produces high power factor and increased efficiency, using less line capacity.
- Built to NEMA Standards for Industrial A.C. Welders. UL and CSA Approval. Series 94 Models carry full one-year guarantee.

Your jobber will gladly provide full information and prices on the MARQUETTE Series 94 Welders. Call him or write us.

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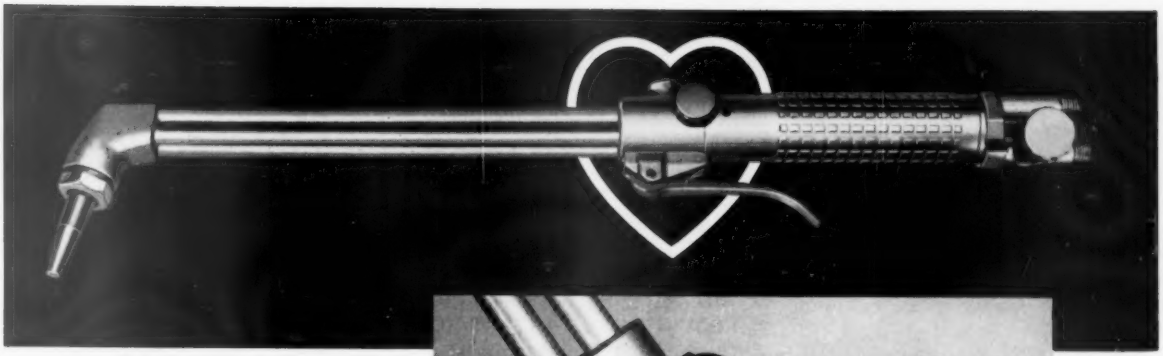

This New Airco 9500 Torch was designed with the operator in mind. Its smooth-working "E-ZE-OX" cutting oxygen valve, its fine balance and heft, its preheat valves located on same side of torch, its rugged triangular tube arrangement, its "corncobbed" knurled handle for nonslip grip — all make the 9500 a favorite with experienced welding men. Sizes 13" to 72".

the Heart of the **NEW AIRCO 9500 TORCH**

is the exclusive **NEW "E-ZE-OX" VALVE** for Cutting Oxygen

When an operator starts a cut with the Airco 9500 Torch, the new "E-ZE-OX" valve lets him open the cutting oxygen valve smoothly — and effortlessly — so there is no splash of molten metal. Nor will the torch kick up to mar the plate outside of the work area. This is particularly important in piercing starts. Heads available in three angles: 45°, 75° and 90°. Look in the Yellow Pages of your phone book under "Welding Equipment and Supplies" for the Airco Office or Authorized Airco Dealer nearest you.

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WELDING AT WORK

to do the job better and cheaper

40-FOOT lengths of 8-inch aluminum pipe are positioned for welding on Alcoa's new automatic pipe welding machine.

Developments make possible wide scale

POINT COMFORT, TEXAS: That oil country usage of aluminum pipelines on a major scale is feasible today has been proven by Alcoa.

Alcoa has just completed installation of a 4,500-foot, 8-inch aluminum pipeline, part of a gas-gathering system at its Point Comfort operations. Two Alcoa cost-cutting techniques were used for the first time: Unistrength pipe and a high speed, automatic pipe welding machine.

Buried without protection, the aluminum line costs only four percent more than coated and wrapped steel lines of comparable size. This small premium is overcome by aluminum's high corrosion-resistance, maintenance of product quality and non-sparking characteristics.

Unistrength pipe is a seamless, one-piece tubular product, that pro-

OPERATOR POSITIONS X-ray head. Lead shield behind pipe prevents X-ray scatter.

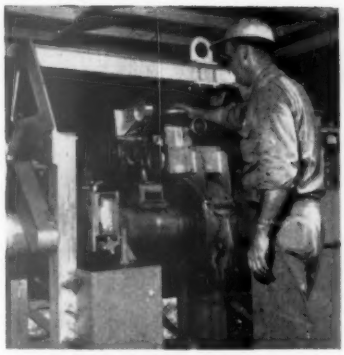
OPERATOR CONTROLS exposure from control box in the rear of a truck.

Dow Chemical inspects welds with portable X-ray units

MIDLAND, MICHIGAN: The Dow Chemical Company has found the Baltospot 200, a lightweight, portable X-ray unit produced by Balteau Electric Co., a very useful accessory for maintaining quality control on construction welding jobs.

In the chemical industry, high pressure and highly corrosive materials are a constant challenge to weld quality. X-ray inspection offers a quick and constant check on procedures, techniques and operators to insure maximum quality in critical welds.

Equipment used by Dow handles pipes and vessels up to 30-inches in diameter. Metal thicknesses normally run from one- to 1½-inches. It is also used on metals such as stainless and aluminum.



ALCOA ENGINEER makes final adjustment on welding machine head.

PIPE WELDER makes one pass on 8-inch pipe in only 17 seconds.

WELDED JOINT in aluminum pipeline is brushed before inspection.

use of welded aluminum pipelines in the oil field country

vides for efficient welded joints by having a heavier wall thickness at pipe ends than along the length. A thinner wall along the pipe length sharply reduces pipe weight and lowers material cost. At Point Comfort, Alcoa used 8-inch, Schedule 40 Unistrength pipe in 6063-T6 alloy. Nominal wall thickness at pipe ends was .322-inches; along the length it was .204-inches. Varying the wall thickness cut pipe cost 20 percent compared to similar lines installed prior to Unistrength pipe.

Further savings were made possible by a new automatic pipe welding machine. The welder is the first machine capable of producing sound, full penetration welds without the use of back-up rings. This unit completes a pass on 8-inch pipe in just 17 seconds. Overall effect was to cut pipe laying time. This reduced the basic cost differential between aluminum and steel.

Lavaca Pipe Line Company installed the new 4,500-foot line, using 40-foot pipe sections. The pipeline, which will carry dry gas at a pressure of 500 psi, conforms to the design requirements of the ASA Code for Pressure Piping.

4-station automatic welds 300 motor stators an hour

CLEVELAND, OHIO: An automatic tungsten arc welding machine makes small motor stators faster and better than cementing. The stators are made of 24 laminations 13/16-inches in diameter; stacks are .342-inches high. Production of 20,000 to 30,000 stators a month is needed.

A four-station rotary-indexing machine developed by Cecil C. Peck Co. makes three welds at 120° spacing.

Because of high production requirements (300 pieces an hour), two or more persons can load laminations on arbors which the operator puts in the machine at the first station.

As the machine indexes to the second position, a height control passes or rejects stacks under compression. If stack is rejected, the machine unclamps and indexes without welding.

Three tungsten arc torches are mounted at 120° spacing in the third station; an electro-magnetic unloader, mounted in the fourth station, removes the welded stator and internal arbor from the tool nest and puts it on a conveyor.

new . . . Silicon Type WS

200, 300, 400 and 500 Amperes
230/460 Volts
60% Duty Cycle

Silicon diodes in the three-phase, full-wave rectifier are the heart of the WS welder. These diodes have a capacity far in excess of the rating for the welder and are hermetically sealed against dust, oil, water and acid fumes by a new bonding process. Each diode is thoroughly tested before and after insertion in the bridge.

Watch Westinghouse for New Developments in Welding

For More Information Circle No. 81 on Reader Service Card.

Rectifier Welder

- *Maximum Performance at Minimum Cost*
- *Highest Degree of Electrical Efficiency*
- *Most Compact Welder in the Industry*
- *Extremely Low Maintenance*

The Type *WS* silicon rectifier welder reflects engineering skill of the highest order. This welder is designed for maximum performance and reliability. It is a product of experience—developed in the Westinghouse laboratories and tested in the field under a variety of conditions. The welder you purchase will be checked out in every detail before it leaves our factory. Every conceivable precaution has been taken to assure you of a faultless piece of equipment.

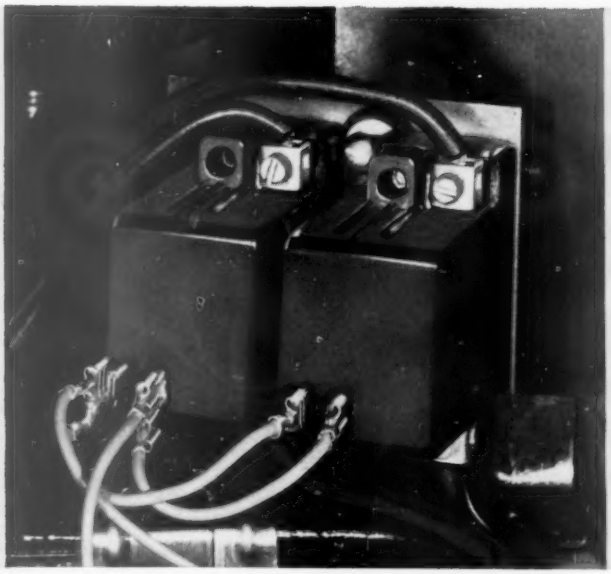
Westinghouse pioneered this completely new concept in industrial welding machines over 10 years ago. Since that time another refinement of the rectifier-type welder was achieved by Westinghouse through the use of silicon diodes. The ultimate in silicon rectifier machines is the Westinghouse Type *WS*.

No other welder on the market has the electrical circuitry to produce sound quality welds as consistently as the *WS*. It provides easier starting, arc stability and maximum drive. Silicon rectification means top welding performance.

The *WS* is the lightest, smallest machine on the market. It is easy to handle and is a space saver. Its bonderized steel casing, protected by baked-on enamel, gives it a weatherproof construction. The high-quality materials in this welder will render long life and trouble-free service.

Learn more about this reliable source of power for welding!

Contact your nearest franchised Westinghouse welding distributor—or write: Welding Division, Westinghouse Electric Corporation, 4454 Genesee Street, Buffalo 5, New York. J-22150



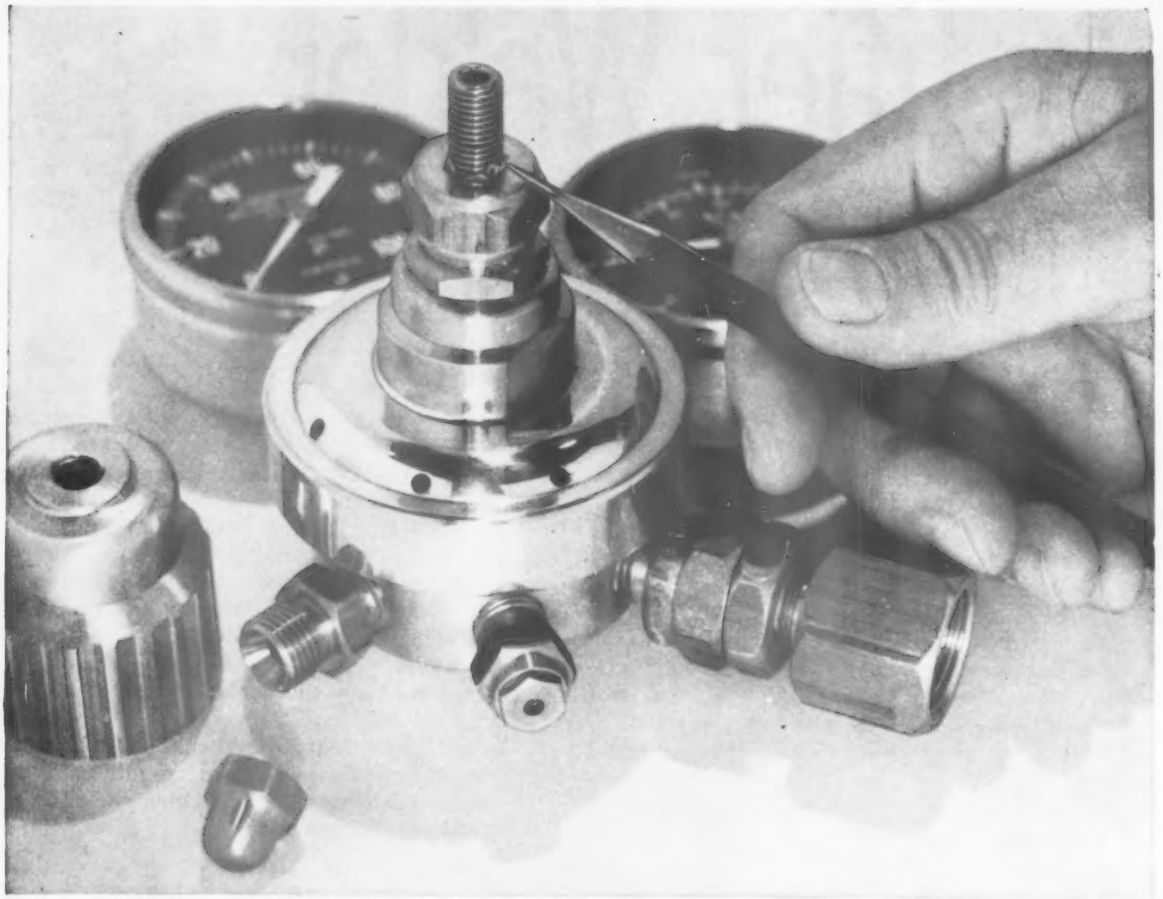
The inverse time relay shown here allows adequate time delay for arc starting at high current setting and freedom from nuisance power interruptions—yet it protects against serious short circuit faults. Capacitors divert and store peak, high-value, short-time voltage spikes that occur when electrical current is broken.

The Type WS has virtually no moving parts to wear out; thus, replacement is at a minimum. The easy access panel shown here makes routine maintenance and air cleaning of the rectifier bridge a fast, simple operation. Be cost-wise, avail yourself of this extremely low maintenance!

YOU CAN BE SURE...IF IT'S Westinghouse

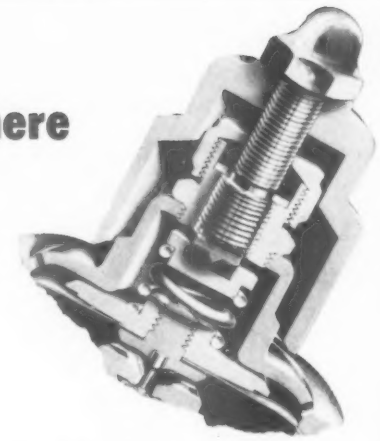
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

For More Information Circle No. 81 on Reader Service Card



sealed in smoothness . . .
neither dirt nor trouble can enter here

Tension screw wear and sticking is a sign of poor design and inadequate manufacture—it is not necessary for you or your operator to struggle with regulator tension screw adjustment. The answer to this problem is simple—*keep foreign matter out of the threaded parts.* This tension screw is fully protected by a unique packing and a special type of friction bushing. Just try this regulator tension screw—adjust it yourself and feel how smoothly it works; you can reach maximum delivery pressure effortlessly.



this is the inside story of a wonderful improvement in tension screw design and action. *No other regulator has this patented feature . . .*

National of . . . california

NATIONAL welding equipment company... 218 fremont street san francisco 5 california

For More Information Circle No. 57 on Reader Service Card.

GOLD STAR SR

This d-c rectifier type welder does more things better than any other welder of its class because —

a. Its new transformer (Miller designed and built) has integral flux diverter.
b. Its new weld stabilized circuit delivers the ultimate in speed of metal deposition.
c. Its new completely sealed semi-metallic rectifier — designed for welding — provides the most efficient d-c for welding ever devised.

These features contribute to the Gold Star SR's greater arc stability, denser welds, easy arc starting and flexibility to handle all electrodes in all positions.

Performance-proved wherever profits are important, the Gold Star SR is available in single and duplex models of 200 to 1200 amperes at 60% duty cycle ratings.

" . . . if it's MILLER you know it's the finest . . ."

GOLD STAR *All-Weather* SRH

The features that set the SR above and beyond the normal standards of welder performance belong to the SRH also. But, in addition to the horizontal design for easier stacking and paralleling, this welder has an "all-weather" construction that includes baked varnish coated transformers and rectifiers plus phosphatizing and painting of all base and sheet metal — even fan blades. Cam-Lok receptacles are standard equipment. The Gold Star SRH welds real well.

Complete specifications on these Gold Star models will be sent promptly.

miller Electric Manufacturing Company, Inc., APPLETON, WISCONSIN

EXPORT OFFICE: 250 West 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

For More Information Circle No. 54 on Reader Service Card.

WELDING MANAGEMENT

watches these developments

Ford's Falcon (top) and Dodge's Dart (bottom) . . .

ALL-WELDED *construction that makes a single unit of automobile frames and bodies is a highlight of the new, smaller automobiles being introduced by American manufacturers. Ford says their Falcon has "Unitized" construction, while Dodge's Dart features "Unibody" unit construction. In either case the single unit construction helps combine maximum strength and rigidity with minimum weights. See pages* 42, 43 *and* 44 *for details.*

AN INTENSIVE TRAINING COURSE in nondestructive testing is conducted regularly in Chicago by Magnaflux Corp. Since the first of the year, 13 such five-day (40 hour) sessions have covered the theory and practice of nondestructive testing. Each week-long class is limited to eight men. Each student receives individual attention and a chance to process actual pieces from a "library" of over 800 typical parts having known defects.

Attendance is by prior registration. The course fee is $100.

A NEW TITANIUM ALLOY *described as "far superior in strength, ductility and toughness" to any comparable alloy now commercially available has been developed in the Research Division of New York University's College of Engineering. Nominally composed of* 6 *percent aluminum,* 6 *percent vanadium,* 2 *percent tin, .5 percent iron, .25 percent copper and* 85.25 *percent titanium, the alloy has exhibited at use temperature properties far exceeding those originally required by sponsoring Watertown Arsenal Laboratories.*

IMPORTS OF STEEL *mill products from foreign countries totaled* 410,005 *net tons during June,* 1959, *and exceeded exports for the seventh consecutive month, according to the American Iron & Steel Institute. With pre-strike buying a factor, the June import total was up* 25,218 *tons as compared to May and up* 283,579 *tons in comparison to the total for June,* 1958. *Imports during the first half of* 1959 *were greater than in any full year between* 1954 *and* 1957. *Trends are shown in this table:*

	Imports (Net Tons)	Exports
June 1958	126,408	163,309
July	171,179*	169,345
Aug.	156,666	171,120
Sept.	179,555	180,685
Oct.	209,569	251,410
Nov.	174,611	238,998
Dec.	230,599*	169,508
Jan. 1959	229,369*	161,375
Feb.	240,769*	167,586
Mar.	287,417*	177,901
Apr.	359,450*	178,029
May	384,787*	165,856
June	410,005*	191,355

Months in which steel mill product imports exceeded exports.

A MOVE HAS BEEN MADE by the Aluminum Company of America to meet a sharply rising demand for strong, easily welded aluminum sheet in missiles, ships, trucks, storage tanks and structural applications. Richard A. Sweet, Alcoa sales manager for sheet plate, said company mills now are producing sheet from 5456 alloy—highest strength composition available in the readily weldable aluminum-magnesium alloy series. First introduced in plate gauges only (.250-inches minimum thickness), the 5456 alloy is now rolled in thicknesses ranging from .051- to 2.00-inches.

IN 1959 *sixteen railroads will weld a total of* 500 *miles of track using* Ribbonrail *oxy-acetylene pressure welding, a process developed by Linde Company, Division of Union Carbide Corp. According to Linde's Railroad Department, rail welding activity at the present time is far greater than it was a year ago; a further increase is expected in* 1960.

"A DESIGN APPROACH to Quality Control of Structural Welding" which appeared in WELDING DESIGN & FABRICATION for September, 1959, page 54, is being reprinted by the Southern Division of the American Council of Independent Laboratories, Inc. Copies of the reprint will be distributed to architects, engineers and contractors.

For More Information Circle No. 38 on Reader Service Card.→

Weld anywhere with P&H portable welders!

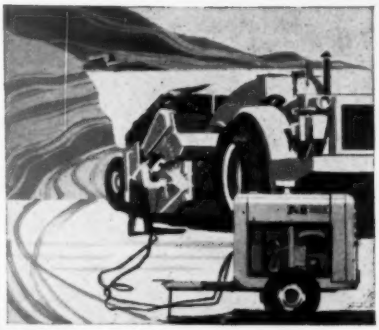
5 engine-driven models enable you to match your needs for construction, pipeline, maintenance, and repair welding in the 25- to 500-amp range

If you use portable welders, you haven't looked at the field until you've seen the new, broad P&H line. Five different models give you a wide choice of sizes to meet your needs and your pocketbook. Easy, precise voltage control and superior current and arc stability enable operators to lay down sounder, cleaner welds faster — prevent burn-through and popouts. The results: fewer rewelds and no costly call-backs.

The rugged, compact P&H welders are built to withstand the heavy use and rough handling on field jobs. They need less care — and they are easier to service. Powerful engines deliver power to spare — with gas-miser economy. A dependable idling control automatically slows the engine down to idling speed when not welding — saves gas and oil, cuts wear.

P&H engine-driven welders come skid- or wheel-mounted — with manual or 6-volt electric starting. For information, write Dept. 3088, Harnischfeger Corp., Milwaukee 46, Wis.

P&H HARNISCHFEGER
WELDERS • ELECTRODES • POSITIONERS



HERE ARE THE FIVE P&H SIZES!

WN-180
Handy, low-cost DC welder for shop and field work in the 25- to 200-amp range.

WNG-200
Compact, light-weight portable for heavy-duty DC welding ranging from 40 to 250 amps.

WNG-300
This rugged middleweight answers your need for trouble-free welding in the 60- to 375-amp class.

WNG-400
Here's cost-cutting DC weld power for the big jobs requiring 80 to 500 amps.

WND-303
This is a diesel-powered newcomer to the P&H line. Unit has a welding range of 60 to 375 amps.

OUR 75TH YEAR
P&H 1884 1959

How Harry Grieger

Harry F. Grieger is general manager of one of New England's thriving industrial distributing organizations, New Haven's Coe & Brown Company. In the business for more than ten years, Harry Grieger started out with a well-known competitive line of abrasive products and found they just didn't meet his standards. Switching to Bay State, he has built his business rapidly and credits Bay State products and service with a "considerable share in this company's growth."

unclogged a bottleneck at Pioneer Manufacturing

When a company has to work double shifts to keep up with customer demand, it's a pretty sure sign that the company *demands top efficiency* from its suppliers.

That's certainly the case with Pioneer Manufacturing Co., Inc. of New Haven, Conn., manufacturers of engineered sheet metal and welded products. Working with both ferrous and non-ferrous metals, they found that the weld-grinding wheels they'd been using loaded up so fast that the down-time situation was getting out of hand and weld-grinding had become an infuriating bottle-neck.

That was when Pioneer Manufacturing called in Bay State distributor, Harry Grieger, General Manager of Coe & Brown Company. He discovered that the only surprising thing about the situation was how easily it could be solved. He simply specified Bay State's Blue Flash, raised hub disc-wheels and the bottle-neck vanished . . . because Blue Flash wheels cut cost and consistently gave a higher rate of stock removal than any other wheel on the market. As a result, production zoomed, the portable grinder operators were delighted and the customer was more than slightly pleased with the improvement in the company's profit picture.

Like Harry Grieger, the Bay State distributor in your area is a trained abrasive specialist. He's as glad to tackle tough problems as he is simple ones and you'll find he's a mine of ideas on ways to improve grinding technique and cut abrasive costs . . . because *better grinding at lower cost, that is his business.*

Operator Lawrence Jennette grinds weld bead on steel brace for frame of vibration test equipment, designed for aircraft and missile manufacturers *(guard removed for photography).*

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.

For More Information Circle No. 17 on Reader Service Card.

HARRIS

universal pressure welding torch No. 43 and the No. 49 cutting attachment will

outstanding features:

All welding assemblies and cutting attachments operate on *less than 1 pound* of Acetylene, permitting complete withdrawal of all the gas.

Safer . . . virtually impossible to back oxygen into acetylene line.

Exceptional Flame Stability, due to unique mixing principal.

MAKE US PROVE THESE STATEMENTS

Call your nearest Harris Distributor for a Demonstration—or write to us.

HARRIS

HARRIS CALORIFIC CO.

5501 CASS AVE. • CLEVELAND 2, OHIO

For More Information Circle No. 39 on Reader Service Card.

NEW FROM TEC

THE NEW TEC AIR-COOLED TORCH!

MODERN DESIGN BY TEC

Tec research and endless testing have provided an easy handling and smooth, effortless operating, the most up-to-date air-cooled torch on the market.

USER MINDED ECONOMY

Tec Visuweld transparent Gas nozzles (both standard and off-set) and Tec chucks are interchangeable with the new air-cooled torch . . . no need to stock or store new parts.

GAS SAVING ECONOMY, TOO

Preliminary testing has already indicated that considerably less gas with greater coverage is afforded with the new air-cooled.

RUGGED CONSTRUCTION

Durable and long lasting due to one piece construction of phenolic plastic reinforced with macerated fiber glass.

Contact your local distributor or write:

SPECIFICATIONS

Engineered to most efficient performance.

MODEL 3110 (Pencil Grip)
Rated Capacity:
Continuous duty cycle: 80 Amp.
Reduced duty cycle: 100 Amp.
Overall length: 9¾"
Handle diameter: 1 inch.
Maximum electrode length: 6 inches.
Electrode diameter: .020, .040, .0625.
Cable lengths: 12½ or 25 feet.

MODEL 3330 (Pencil Grip)
As above except:
Rated Capacity:
Continuous duty cycle: 130 Amp.
Reduced duty cycle: 150 Amp.
Electrode diameter: .020, .040, .062, .093.

MODEL 3220 (Angle)
Same as 3110 except:
Overall length: 8 inches.
Handle diameter: 1 inch.
Electrode length: 3 inches.

MODEL 3440 (Angle)
As above except:
Rated Capacity:
Continuous duty cycle: 130 Amp.
Reduced duty cycle: 150 Amp.

TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. MANUFACTURERS OF VISUWELD EQUIPMENT

For More Information Circle No. 71 on Reader Service Card.

"Materials and Fabrication Preview of the Soaring '60's" is theme of 41st annual Metal Show

TRAILBLAZING in uncharted realms of metals engineering will be done by participants in the 41st National Metal Congress sponsored by the American Society for Metals, November 2-6, in Chicago. More than 275 technical presentations will be made in symposiums, panel discussions, seminars and formal sessions of the ASM and seven cooperating groups.

Theme for both the Exposition and Congress phases of the annual "Metal Show" is "Materials and Fabrication Preview of the Soaring '60's". The Exposition will be held in the International Amphitheatre with Congress sessions in several Chicago Hotels.

Taking part in the Metal Congress, in addition to the ASM, are American Institute of Mining, Metallurgical and Petroleum Engineers; Society for Nondestructive Testing; Special Libraries Association; American Society for Testing Materials; Metal Powder Industries Federation; Metal Testing Institute and the Ultrasonic Manufacturers Association.

WOODSIDE PANEL

"Composite Materials," "Explosive Forming," "Refractory Metals," and "New Fabricating Techniques" will feature the ASM's William Park Woodside Panel Conferences, Monday through Thursday, November 2-5, in the Hotel Sherman.

ASM TECHNICAL PAPERS

ASM sessions Monday through Thursday will have 52 technical papers blanketing the field of metallurgy. Subjects include "Titanium," "High Strength Steels," "Nuclear Metals," "Austenitic Alloys" and "Refractory Metals."

SNT MEETS FIVE DAYS

The Society for Nondestructive Testing will conduct meetings Monday through Friday. General theme is *Reliability and Nondestructive Testing.* Subject matter includes "Nondestructive Testing Correlation with Fatigue Testing" and "Inspection of Brazed Honeycomb Structures".

ULTRASONICS ASSOCIATION

Three papers covering all uses of ultrasonics except inspection will be given at the Ultrasonic Manufacturers Association meeting Thursday morning, November 5, in Hotel Sherman. To be discussed are joining, brazing, cleaning, hardening, soldering, drilling and machining.

These companies are exhibiting welding products

A

Ajax Electric Company
Allison-Campbell Division
American Brake Shoe Company
American Chain & Cable Co., Inc.
American Optical Company
American Pullmax Co., Inc.
Arcair Company

B

Babcock & Wilcox Company
Balteau Electric Corporation
Banner Welder, Inc.
Bausch & Lomb Optical Company
Branson Ultrasonic Corporation
Budd Company

C

Chicago Tool & Engineering Co.
Curtiss-Wright Corporation

D

de Sanno & Son, A.P.
Detroit Testing Machine Company
DoAll Company

E

Eastman Kodak Company
Engelhard Industries, Inc.

F

Fenway Machine Company, Inc.

G

Gas Appliance Service, Inc.
General Electric Company
Grotnes Machine Works

H

Haynes-Stellite Division
Heath Engineering Company

K

Kester Solder Company
King Tester Corporation

L

Lake Chemical Company
Lepel High Frequency Laboratories, Inc.
Lindberg Engineering Company

M

Magnaflux Corporation
Markal Company
Milwaukee Electric Tool Corp.
Mitchell Radiation Products Corp.

N

Narda Ultrasonics Corporation
National Carbon Company
National Ultrasonic Corporation

O

Ohio Crankshaft Company
Olsen Testing Machine Co., Tinius
O'Neil-Irwin Manufacturing Co.

P

Picker X-ray Corporation
Power Transmission Design (Publ)
Precision Metal Molding (Publ)

R

Raytheon Manufacturing Company
Richards Company, J. A.
Riehle Testing Machine Div.
Ryerson & Son, Inc., Joseph T

S

Solas Corporation of America
Smith Corporation, A. O.
Sperry Products, Inc.
Steel City Testing Machines, Inc.
Storch Products Company

T

Tempil Corporation
Turco Products, Inc.

U

Union Carbide Corporation

W

Wales-Strippit, Inc.
Welding Design & Fabrication (Publ)
Welding Illustrated (Publ)
Wells Manufacturing Corporation
Westinghouse Electric Corporation

CUT GLOVE COSTS Due to Broken Seams!

AO Drednaut Welder's Gloves

NO SEAMS ACROSS FINGERS! That's why this American Optical Gunn-type Glove provides maximum resistance to wear, more comfort — longer life! Leather is specially chrome-tanned split cowhide — tough but flexible. The flat, double-stitched seam at base of fingers is more comfortable than an inverted seam — and it's a feature to look for. One-piece back, wing thumb. 14″ long overall. Has back liner for added protection and comfort.

HERE ARE 3 MORE FAVORITES

From AO'S Complete Line of Quality Specially Chrome-Tanned Split Cowhide Gloves

SC5X163
Very resistant to heat. Protects on gas welding and heaviest amperage electric welding. One-piece base and palm. Welted at all vulnerable seams for added strength. Extra heavy lining on back of hand. 14″ long.

SCTX100
Gunn cut, one-piece back. Wing thumb. Double thickness of leather on first finger and thumb. Lined on back of hand from wrist to fingertips. Full gauntlet. 14″ long overall. Flat seam at palm base.

SC3013
Leather patch on back of hand gives added protection against sparks and molten metal. Thumb and first finger reinforced with leather patch. Reinforcing leather strap around thumb. Full gauntlet. 14″ long.

Always insist on AO Trademarked Safety Products

American Optical COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASS.
Safety Service Centers in Principal Cities

Your nearest AO Safety Products Representative can supply you

For More Information Circle No. 9 on Reader Service Card.

SAN JOSE, CALIF.: John W. Alden, Jr. (left), Ordnance Division, Food and Chemical Corp., and Ronald N. Skow, district engineer for Linde Company, Division of Union Carbide, check the new liquid argon installation at FMC's Ordnance Division in San Jose. The new unit will supply argon gas to be used for training operators in the fabrication of the new M113 aluminum armored personnel carriers.

Farm Boy Wins Lincoln Welding Awards

CLEVELAND, OHIO: Award-winning entries in this year's annual welding competition sponsored by The James F. Lincoln Arc Welding Foundation for farm boys ranged all the way from loading chutes and hay elevators to a raisin shaker. All entries were shop projects constructed by the boys.

National honors were shared by 105 young farmers from 26 states. These boys, and the schools where they study shop mechanics as part of agricultural courses, received a total of $7,000.

Gregg Hollinger of Paul, Idaho, received the top national award of $600 with his branding and dehorning squeeze chute.

All-State Produces More Aluminum Wire

WHITE PLAINS, N. Y.: Production capacity for spooled aluminum wire is about to be tripled by All-State Welding Alloys Company, announces T. D. Nast, president. The company is now in a position to spool, on 1 and 10 lb. spools, every type of aluminum used for welding—#1100, #4043, #718, #5154, #5554, #5356, #5183, #5556, etc. New spooling machines are being added to the home plant in White Plains and at the company's Western plant in South Gate, California.

Next step in All-State's expansion program, says Mr. Nast, is the spooling of various grades of copper wire, such as deoxidized copper and silicon bronze. The company also plans to spool magnesium, stainless steel and mild steel wire.

Hobart Teaches Pipe Welding

TROY, OHIO: A special training course on the welding of pressure piping is now being offered by Hobart Welding School. The course is open to trained and experienced operators only. It features the "uphill" technique of starting at the bottom of the joint and welding to the top.

Upon completion of the course, the operator should be capable of passing the performance qualification of Section IX, ASME Boiler and Pressure Vessel Code.

Form Consulting And Engineering Firm

ATLANTA, GEORGIA: Robert S. Lynch, former chairman of the Atlanta Steel Co., has joined with Frank F. Ford, president of Frank F. Ford and Associates and of Ford Supply Co., to form Ford-Lynch Associates, consultants and sales engineers. Offices of this new organization are located at 1015 Chattahoochee Avenue, N. W.

Welding Institute Covers Stainless Steels

MADISON, WISCONSIN: Stainless steel fabrication problems and their solutions are the subject of a welding institute sponsored here by the University of Wisconsin Extension Division and the Madison Section of the American Welding Society. Dates are Thursday and Friday, November 19-20.

for news about new products

turn to page 94

About AWMA

by E. W. HOLLIS
President
Automatic
Welding
Machinery
Association

Since its formation in April, I have been asked many times, "Just what is the Automatic Welding Machinery Association, its purpose and objectives"?

This is a valid question considering the earlier existence of A.W.S., N.E.M.A., R.W.M.A. and other associations which would seem to have a direct or an overlapping link with the welding industry. Certainly, there can be little justification for this association if it is a duplication of other established groups.

But this is hardly the case. As the state of the art of fusion welding has advanced and has extended to become an integral part of more and more production operations, there has been an increasing need to make the entire process more automatic and repetitive from both the cost and quality standpoints.

This need applies to the handling, positioning, manipulating and holding machines and mechanisms. Some of these are related to the welding head but the majority are more applicable to the work piece or to bringing the work piece and the welding head into proper relationship with each other to perform the automatic welding operation.

To be truly automatic, repetitive and dependable, such equipment must depart from the category of "tools and fixtures"

continued on page 88

HERE'S THE FIRST SEMI-AUTOMATIC OPEN ARC WIRE FOR HIGH STRENGTH WELDS ON MANGANESE STEEL

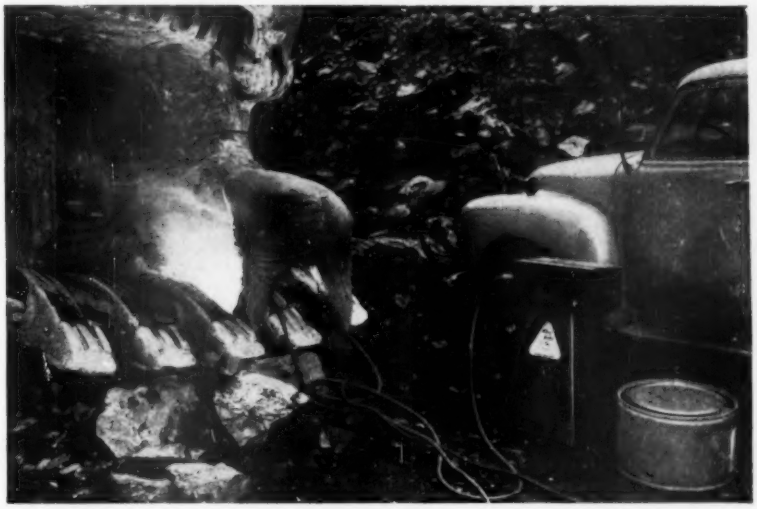
WEAR-O-MATIC WH

Wear-O-Matic WH is the first 7/64″ diameter open arc wire for semi-automatic application providing acceptable high strength properties for welding manganese attachments to manganese or carbon steels.

Here's a new wire providing welds of greater strength and ductility than 14% manganese weld metal that can be applied by the easier, more economical Wear-O-Matic open arc semi-automatic process. The balanced, high alloy content of the fabricated wire is sufficient to overcome the effects of dilution with manganese or carbon steel resulting in a weld deposit in the fully austenitic range. This, of course, provides a tougher, more crack resistant weld deposit.

Wear-O-Matic WH serves a dual role in that the exceptional physical properties that provide strong ductile welds also provide a tough, deformation resistant mass when used as a build-up alloy. The deposit develops a surface hardness of 47–48 Rc under impact providing exceptionally good wear resistance.

NEW NEW NEW NEW NEW



- **For impact and compression resistant attachment welds . . . specify WEAR-O-MATIC WH**
- **For tough, dependable build-up deposits . . . specify WEAR-O-MATIC WH**
- **For greater economy in all of your hard surfacing and maintenance welding, call on your Alloy Rods factory branch or distributor.**
- **Write for Bulletin HS201 for details and locations. Alloy Rods Company, P. O. Box 1828, York, Penna.**

NEW NEW NEW NEW

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

For More Information Circle No. 6 on Reader Service Card.

N.W.S.A. INDEX 1010

ABRASIVE PRODUCTS for the Welding Trade

for your FREE

by CARBORUNDUM®

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NEW

for buyers of welding supplies

to help you be sure about abrasives

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CARBORUNDUM'S NEW CATALOG OF ABRASIVE PRODUCTS FOR THE WELDING TRADE. Here, for your own file, is a complete listing of abrasive products, wheels, belts, discs and cloths, designed, tested and proved for specific welding applications by Carborundum... the most experienced name in abrasives. Each of your purchases, from this *complete* line of abrasives, is backed by Carborundum's multi-million dollar research program, experienced field engineers, factory-trained distributor representatives and proven record of prompt deliveries.

If you have an abrasive problem, in product performance or service, send for your Carborundum Catalog *today* ... it has all the abrasive answers for efficient weld grinding and weld finishing.

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MAIL TO:

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Gentlemen:

Please send me a copy of your new catalog — "Abrasive Products for the Welding Trade."

Name _____

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New Bausch & Lomb Line of

WELDERS' CUP-TYPE GOGGLES

Get a greater degree of eye protection, *plus* economy, *plus* worker acceptance. Injection molded from tough thermoplastic in a cool green color, these new, improved goggles resist high impact, are super comfortable, good-looking and easy to keep clean. Famous B&L Arc-Ban lenses in shades 3 through 12 provide safe, scientific protection against injurious radiations.

S-94 CUP-TYPE Basic Bausch & Lomb welders' goggle with the new two-piece louver side shield that excludes light, lets in air. Bead chain bridge adjustment.

S-84 COVERALL Contoured to fit comfortably against face and over all sizes of regular prescription eyewear. Soft leather nose pad with slide adjustment.

S-85 COVERALL with BRACE BAR Brace bar holds both cups together, so goggles may be slipped up, adjusted, or removed with one hand. The bridge may be widened or narrowed by straightening or deepening curved section of brace bar with pliers.

S-84P COVERALL WITH FACE PAD Only Bausch & Lomb has this coverall welders' goggle with the comfort-fitting, removable face pad. Made of soft sponge rubber in a neutral flesh color, it snaps into place easily and it can be removed for cleaning or replacement. Pads may be purchased separately.

BAUSCH & LOMB
SINCE 1853

Bausch & Lomb Optical Co.
91047 Smith Street,
Rochester 2, N. Y.

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LIBRARY

of welding

Nondestructive Testing

"Nondestructive Testing Handbook" prepared by Society for Nondestructive Testing, two volumes, $24.00. The Ronald Press Company, 15 East 26th Street, New York 19, New York.

This Handbook integrates experience acquired in selecting, applying, and interpreting tests.

From all over the world, the Handbook draws together information from professional journals, society proceedings, committee reports, standard books, company research and operating data, and records and reports of designers and users of testing equipment. Much of the data on test application and interpretation is made available for the first time, particularly in advanced fields such as penetrating radiation, magnetic-field, eddy current, and ultrasonic testing.

The Handbook is edited by Robert C. McMaster of The Ohio State University with a Board of 106 contributing and consulting editors selected from this country and abroad. Throughout, it synthesizes practical know-how and authoritative judgment in nondestructive tests applicable to all industries.

Organized in 54 coordinated sections, the Handbook offers hard-to-find guidance for every organizational level. Over 1,200 charts, drawings, forms, and photographs are included, along with much newly developed data in graphic or tabular form.

Soldering Manual

American Welding Society, Department T, 33 West 39th Street, New York, 18, N.Y. 176-pages, $5.00.

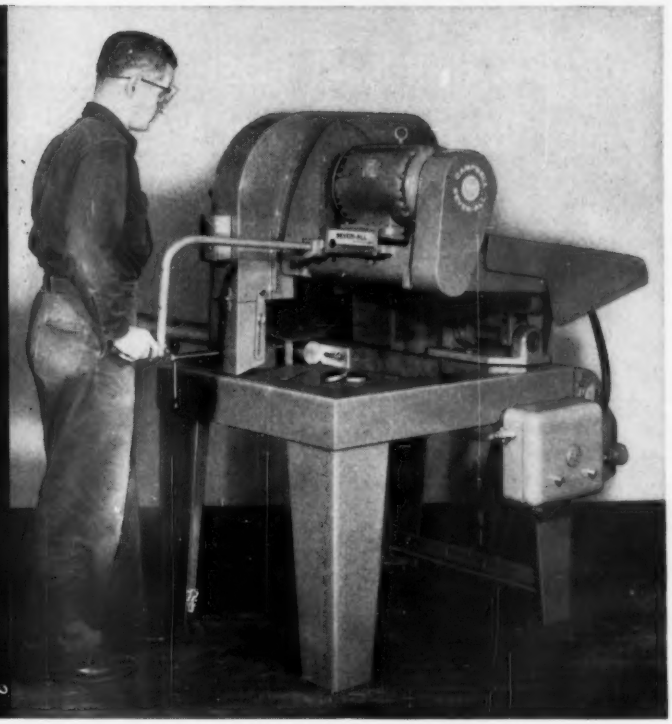
The American Welding Society has announced the publication of the first manual on soldering ever published. Containing 176 pages, 81 illustrations and 34 tables, the book completely covers all phases of soldering.

The 21 chapters deal with the following subjects: principles of soldering; solders; fluxes; joint design; precleaning and surface preparation;

continued on page 28

NEW!

GREATEST CUT-OFF CAPACITY IN ITS CLASS!



• This newest addition to the Sever-All line of abrasive cutting machines—the Model 2-A—provides greater cutting capacity and more flexibility than any other machine in its class. Check these important advantages:

Big capacity • cuts 4" round or square solids, 5½" O.D. pipe or tubing, 6"x1" flat stock, 6" angle iron and 8" channels. Cuts practically all metals.

Fast operation • accurate cuts at the rate of 2 to 3 seconds per square inch. For instance, you can cut a 4" bar of hardened steel in 45 seconds, or a 2" pipe in 3 seconds.

Power oscillation • oscillation—the forward and backward motion of the cutting wheel as it is fed down into the cut—gives you extra cutting capacity without excessive horsepower load on your power lines. It also contributes to longer wheel life and reduced operator fatigue.

Quality cuts • clean, smooth cuts, even on large sections, because wheel oscillation provides cooler cutting action.

Economy • Sever-All abrasive cutting wheels, developed specially for the Model 2-A, assure you of lowest cost per cut.

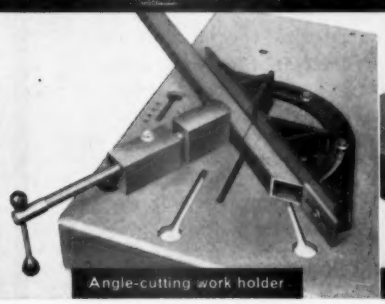
Safe • wheel guard provides complete operator protection.

Minimum maintenance • all bearings are the pre-lubricated and sealed type. Clean, simple machine design permits easy housekeeping.

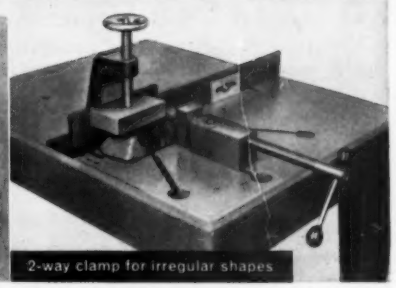
Built to last • rugged machine bed and rigid castings make the Model 2-A first choice for heavy-duty jobs.

VARIETY OF WORK HOLDERS GIVES UNUSUAL VERSATILITY

V-block with quick-action clamp



Angle-cutting work holder



2-way clamp for irregular shapes

Choose the work holders you need from several optional arrangements. These include the vise-type holder shown on the machine at top, plus the V-block, angle-cutting and 2-way clamp fixtures above. All fit interchangeably on the Model 2-A Sever-All. Screw-type and quick-action clamping also may be used interchangeably.

***Write for details** on the new Model 2-A Sever-All abrasive cutting machine. Ask for Bulletin DH-299*

ACCO

SEVER-ALL ABRASIVE CUTTING MACHINES

Allison-Campbell Division, American Chain & Cable Company, Inc.

925 Connecticut Avenue, Bridgeport 2, Conn.

For More Information Circle No. 5 on Reader Service Card.

New Hi-Impact Plastic Insulated

Panel Receptacles and Mating Plugs

Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast
direct mounting on . . .

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• BUS DUCT • JUNCTION BOXES
• WIREWAY or any electrical cubicle

A Complete Line of Welding Accessories and Special Power Distribution Connections

cam-lok DIVISION

EMPIRE PRODUCTS, INC.
P.O. BOX U-98
CINCINNATI 36, OHIO

For More Information Circle No. 21 on Reader Service Card.

continued from page 26

equipment, processes and procedures; flux residue treatment; inspection and testing; copper and copper alloys; steel; coated steels; stainless steels; nickel and high-nickel alloys; lead and lead alloys; aluminum and aluminum alloys; magnesium and magnesium alloys; tin; cast irons; precious metal coatings; printed circuits; and safety.

The manual is equally useful to the amateur and the professional. All phases of soldering are described including the new techniques developed for miniaturization.

Chemical composition of hundreds of solders are given, together with flux formulations for the various metals.

Brazed Titanium Sandwich

J. F. Rudy, R. M. Necheles and H. Schwartzbart, Illinois Institute of Technology for Wright Air Development Center, U. S. Air Force. January, 1959. 98-pages. (Order PB 151663 from OTS, U.S. Department of Commerce, Washington 25, D. C., $2.25.)

This volume identifies the face sheet alloys, brazing alloys, and fabrication methods used to demonstrate the feasibility of fabricating titanium alloy face sheet honeycomb sandwiches by brazing techniques. For the face sheet alloy, a 16V-2½Al material was selected. A 5Al-2¾Cr-1¼Fe was chosen for brazing above the beta transus of the primary material. An evaluation of 17 brazing alloys showed Ag-0.25Mg-0.2Ni-1Li and Ag-28Cu-0.2Li, the stronger of the two, to be best for brazing titanium-cored panels at a brazing temperature of 1500F. These alloys plus Ag-7Cu-0.2Li and Ag-30Cu-10Sn were found satisfactory for brazing stainless steel cored panel at 1600F.

A quartz lamp radiant heat brazement process was developed and found applicable to titanium alloy face sheet materials and sandwich panel production in general. The technique showed such advantages over other furnace retort methods as inherent rapid heating and cooling rates, good temperature uniformity and brazing time control, and general cleanliness of the heat source for atmosphere purity.

Preheating carbon-moly tubing with Victor Model J27 torch and Type 28 heating nozzle at Besler Corp., Emeryville, Calif.

The man on the job likes Victor torch flexibility

Flexibility is built into all Victor torches, regardless of size. Here, for example, Series J torches are being used to preheat, then weld 5/8" O.D. with .095" wall tubing for steam generators. With a change of nozzles and tips these same torches braze and solder . . . with the addition of a cutting attachment, can be used for light cutting applications and ocasional short jobs up to approximately 2" steel.

Victor Series 100 torches for medium-duty work and the famous Series 300 for tough, heavy work, give you this same flexibility . . . heating, welding, brazing, soldering, cutting. All 3 sizes, with proper cutting attachment, can be used with oxygen-acetylene, oxygen-propane, oxygen-city or natural gas.

Ask your Victor dealer for a demonstration now. You'll see for yourself how Victor torches answer all your welding and cutting needs.

Welding 5/8" O.D. with .095" wall tube into generator coil, using Model J27 torch and Type 17 welding nozzle with oxy-acetylene.

Profitable dealerships open in a few areas; inquire now.

VICTOR for welding and cutting

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

62

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1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

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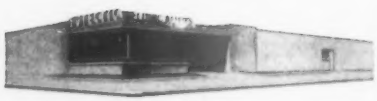
350 FACTORY TRAINED TECHNICAL REPRESENTATIVES ARE AT YOUR DISPOSAL FOR CONSULTATION AND PRACTICAL ASSISTANCE WITH YOUR WELDING PROBLEMS.

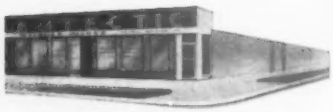


Toronto, Canada

St. Louis, Missouri

Seattle, Washington

Los Angeles, California



Chicago, Illinois

Atlanta, Georgia

Dallas, Texas

SOME OF THE KEY GEOGRAPHICAL LOCATIONS OF EUTECTIC WELDING ALLOYS SERVICE & STOCK FACILIITES.

To provide prompt, on-the-job service to its thousands of customers all over the United States and Canada, EUTECTIC maintains an extensive network of Service Center Warehouses. EUTECTIC spans the world and operates manufacturing plants through affiliated companies in Canada, Mexico, Brazil, Switzerland, England, Germany, France, South Africa.

Columbus, Ohio

Detroit, Michigan

Montreal, Canada

EUTECTIC HAS BEEN A RECOGNIZED LEADER

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ON A BREAKDOWN ANYWHERE, ANYTIME.

To the Welding Industry...

EUTECTIC SERVICES MAKE THE BIG DIFFERENCE

World Headquarters
Flushing, New York

Strategically located Service Center Warehouses... *backed by 350 fully qualified EUTECTIC Technical Representatives experienced in welding and welding problems*... bring world-renowned EUTECTIC "Low Temperature Welding Alloys,"® Fluxes and Welding Aids within easy reach of weldors and welding users everywhere.

More than one-hundred-sixty different and better Alloys and Fluxes, compounded on the original Low Heat Input process developed by EUTECTIC, are now available from local supply centers in the same uniform, high quality condition as the day they left the factory!

EUTECTIC WELDING ALLOYS CORPORATION is the originator, patent holder and sole world-wide manufacturer of EUTECTIC "Low Temperature Welding Alloys". These unique products, the result of 50 years of research and development, minimize warping, distortion, weld embrittlement, and other damaging effects to metal encountered with common, high heat materials.

If you have a welding problem... or would like dramatic proof of the time and money saving possibilities inherent in the use of EUTECTIC products... write or call any EUTECTIC Office, Warehouse or Technical Representative.

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Warehouses and Service Centers in ATLANTA; BOSTON; CHICAGO; COLUMBUS, OHIO; DALLAS; DETROIT; LOS ANGELES; ST. LOUIS; SEATTLE; BERKELEY, CALIF.; HURON, SO. DAKOTA; PHOENIX, ARIZONA.

CANADIAN PLANT AND HEADQUARTERS: MONTREAL
WAREHOUSES: DARTMOUTH, N. S., TORONTO AND VANCOUVER

FOR 20 YEARS IN THE WELDING INDUSTRY

For More Information Circle No. 32 on Reader Service Card.

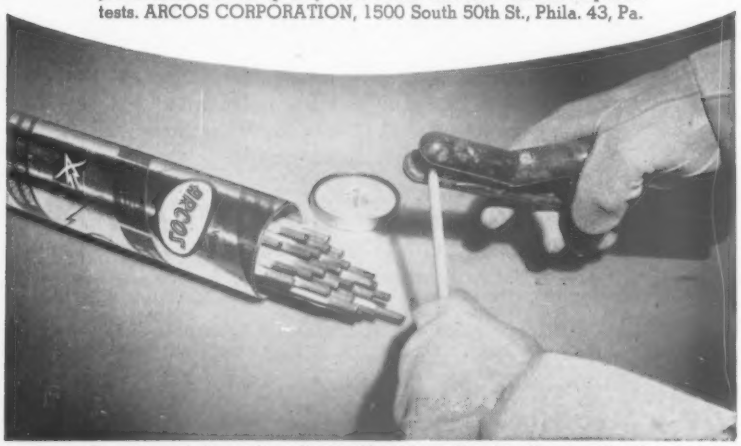
Job report courtesy of
Superior Welding Company, Decatur, Ill.

How to get more *positive* results when Welding Stainless

WELD WITH ARCOS

STAINLESS ELECTRODES

These vessels—used for processing a chemical where utmost product cleanliness is required—were made of 304 ELC Stainless Plate and welded with Arcos Chromend 19-9 CB (347) electrodes. The fabricator selected these electrodes for the "right" analysis to resist corrosion and to assure a surface, including the weld areas that would take a high polish both on the inside and outside to make thorough cleaning easy. It's proof again that whatever the job demands Arcos quality weld metal will meet all the required tests. ARCOS CORPORATION, 1500 South 50th St., Phila. 43, Pa.



For More Information Circle No. 11 on Reader Service Card.

MEN ON THE MOVE

APPOINTMENTS:

WILLIAMS

David Williams has joined the sales department at *Fibre-Metal Pacific, Inc.*, Bell Gardens, Calif. Williams will cover the San Francisco Bay area contacting distributors of safety and welding equipment on a wholesale basis only.

Karl E. Krogstad has been appointed a field engineer at the Philadelphia district office of *Norton Co.*

T. C. Fair has been appointed sales engineer in the Pittsburgh area for *Coast Metals, Inc.*, of Little Ferry, N. J. Mr. Fair, who will have offices in the Investment Building, was formerly with *National Cylinder Gas Division of Chemetron Corp.*

PROMOTIONS:

BROWN

PEACOCK

Richard K. Brown has been appointed vice president and general manager of **National Welding Equipment Co.**, San Francisco. He is succeeded as general sales manager by **C. B. (Bart) Peacock. Ernest L. Mathy** continues as president and chairman of the board.

F. H. Foglesong has been named to the newly created position of manager of alloy sales for the *Babcock & Wilcox Company's Tubular Products Division*. He will make his headquarters in Beaver Falls, Pa. Succeeding Mr. Foglesong as manager of the division's Detroit district sales office is **A. D. Zar.**

Sidney Wade has been named vice-president—distributor products of *Linde Company, division of Union Carbide Corp.* He had been manager, distributor products, for Linde.

Edward J. D'Amore has been appointed Service Sales Manager for the *Brazing & Wire Divisions of the United Wire & Supply Corp.* The announcement was made by **J. G. Landrigan,** general sales manager.

BARTZ

Named sales manager of *Airline Welding and Engineering,* Hawthorne, California, is **Ed Bartz.** He had served in an executive capacity with Airline since August, 1957. Mr. Bartz will be in charge of sales of weld planishers, manipulators and positioners.

ELECTIONS:

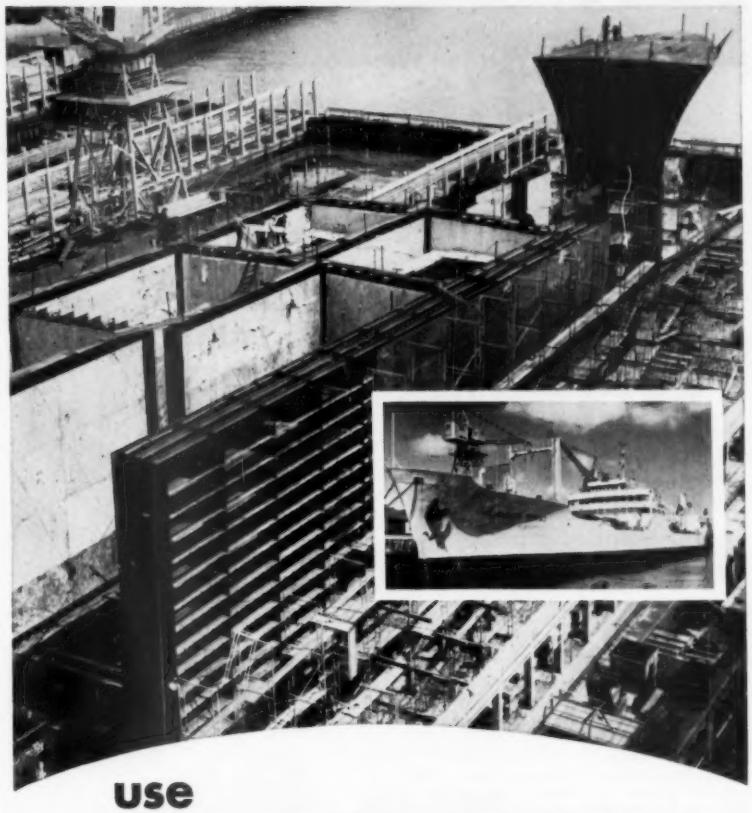
Elected as advisory members of the Board of Directors, *Emerson Electric Mfg. Co.,* were **Edward L. O'Neill,** vice president and general manager of Emerson Electric Co.; **William L. Davis, Jr.,** vice president of engineering, and **Charles G. Gulledge,** vice president of Electronics & Avionics.

RETIREMENTS:

SHERWOOD

Richard L. Sherwood, who has been territorial manager for the last 7 years for *Hobart Brothers Co.,* has retired. He will be succeeded by **Robert K. Buchanan,** until recently eastern district manager with headquarters in Philadelphia. Mr. Buchanan will assign distributor territories.

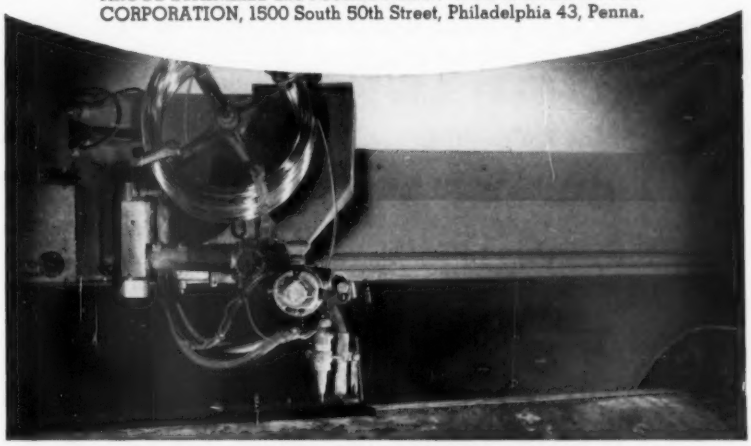
When submerged arc welding requirements are HIGHLY UNUSUAL!



use

ARCOSITE BONDED FLUX

The SS Angelo Petri—the first of its kind—is a new wine tanker carrying 26 welded cargo tanks with a 2 million gallon bulk capacity. Especially unusual was the use of submerged arc welding on both sides of the type 316 stainless-clad steel tanks. ARCOSITE C-17 FLUX and Arcos CHROMENAR 25/20 bare wire were used to assure proper physical, corrosion resistant properties, and joint soundness. To control dilution on the stainless side, the clad side was automatically gouged slightly by carbon arc. Write today for information on ARCOSITE BONDED FLUXES and ARCOS STAINLESS and NICKEL ALLOY ELECTRODES. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Penna.



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INSIDE *and* OUT...

NOW

MORE COMFORTABLE
MORE DURABLE
...and safer than ever!

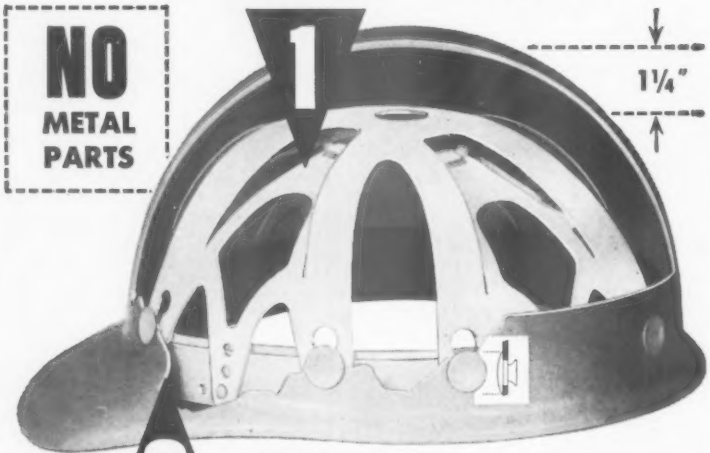
EXCLUSIVE

POLYETHYLENE
DUAL SUSPENSION
strong, pliable, comfortable, easy to clean

NEW "**DUAL** *SUSPENSION" for SAFETY*

NO METAL PARTS

1



NEW 2 "DUAL *FIBERGLAS" SHELL for DURABILITY*

The BIG NEWS from FIBRE-METAL is a DOUBLE FEATURE:

1) The polyethylene Suspension is a *single unit* composing both a "fixed" safety factor as well as an "adjustable" clearance from the shell. EACH ONE, INDIVIDUALLY, PASSES FEDERAL SPECIFICATIONS! The entire Suspension, including the headband, is soft and pliable for comfort, rugged for safety, clean in design that stays clean and is easy to clean.

2) The Shell has an added "veil" of fine glass fibres that achieves a thin layer of resin and glass fibres close to the surface for superior weathering and abrasion resistance.

These "two features" are exclusive with FIBRE-METAL!

OTHER FIBRE-METAL FEATURES

3) New "flush buttons" in shell and headband increase wearing comfort

4) Polyethylene Suspension will not mildew, sour or rot. Easily cleaned or sterilized. Unaffected by detergents.

5) Headband of softly pliable polyethylene conforms to head...adjusts to any head size from 6⅝ to 8.

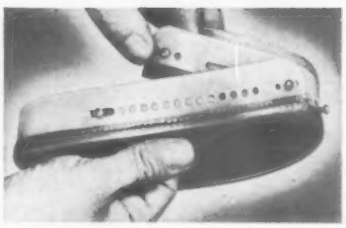
6) All edges of suspension rounded for comfort.

7) Laces are recessed to prevent discomfort ...and to adjust for depth.

8) Triple adjustment of headband to *raise, lower or tilt* headband to increase individual comfort or to adjust for adverse work conditions.

9) Provision for chin strap in every hat and cap.

This NEW DUAL Suspension is interchangeable in *SuperGlas, SuperLite* and *SuperLectric* Hats and Caps...and is interchangeable with all Fibre-Metal Suspensions in the field.



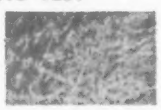
Headband of softly pliable polyethylene conforms to head...ADJUSTS TO ANY HEAD SIZE from 6⅝ to 8.

SUSPENSION REMOVABLE, but ONLY headband-sweatband need be replaced...saves time and 30% replacement cost. No dangerous metal parts.

DUAL FIBERGLAS! The fine glass fibre "veil" achieves a thin layer of resin and glass fibres close to the surface for superior weathering and abrasion resistance.

PROVED BY 14½ MONTHS WEATHERING TEST

View of an ordinary safety hat shell surface after 14½ months of actual weathering in sun, wind and rain...24 hours a day.



Here's the nearly new look of Fibre-Metal's SuperGlas Shell after 14½ months of weathering. Abrasion tests show similar results.

ASK YOUR WELDING & SAFETY SUPPLY DISTRIBUTOR FOR BULLETINS

THE FIBRE-METAL PRODUCTS COMPANY

CHESTER, PENNSYLVANIA
In CANADA: Fibre-Metal (Canada) Limited, Toronto

OVER 52 YEARS OF WELDING & SAFETY

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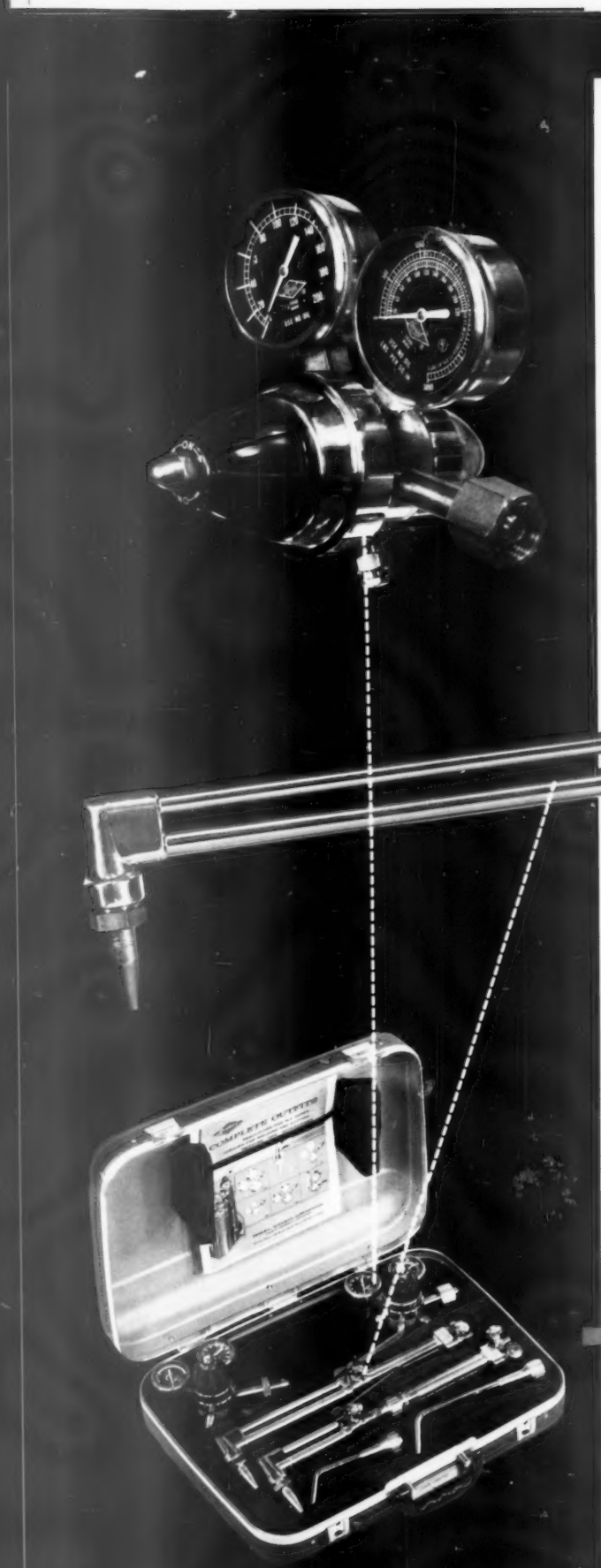
Circle No. 49 on Reader Service Card. ⟶



WHAT'S INSIDE THE "CASE OF JEWELS"?

Liquidweld torches and regulators—as perfectly balanced as the finest rifles.

Liquidweld Regulators

- *Finger-tip control is provided by easy-grip adjusting cap and self-lubricating, nylon-pointed adjusting screw.*
- *Freezing, vibration and seat ignition are eliminated—even when subjected to full cylinder pressure—by exclusive stabilized seats.*

Liquidweld Torches

- *Longer life, better flame control and uninterrupted performance are assured by nylon-tipped needle valve stems.*
- *Designed with the precison of a timepiece, these all-purpose torches cut, weld, braze, and heat all metals, from the lightest to the heaviest.*

For these and many more production-boosting advantages, call your Liquid Carbonic representative—ask to see his "Case of Jewels" today!

GENERAL DYNAMICS CORPORATION

GD CORPORATION | L-C DIVISION

Liquid Carbonic Division
135 South LaSalle Street
Chicago 3, Illinois

In Canada: Liquid Carbonic Canadian Corporation, Ltd., Montreal 9, Quebec

A major producer of compressed gases: oxygen, acetylene, nitrogen, hydrogen, argon, carbon dioxide, nitrous oxide, helium and various gas mixtures

GENERAL DYNAMICS CORPORATION
Liquid Carbonic Division
Dept WE, 135 S. LaSalle St.
Chicago 3, Ill.

I would like to know more about Liquidweld apparatus.

( ) Please arrange a demonstration at my convenience.
( ) Please send literature and net industrial prices.

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Company.....

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FOR

RESISTANCE WELDING SUPPLIES

R. W. M. A. CLASSES OF ALLOYS
IN CASTINGS, FORGINGS AND BAR STOCK &
COPPER TUNGSTEN ALLOYS

WELDER WHEELS IN ALL ALLOYS
AND SIZES TO SUIT YOUR REQUIREMENTS

ALL TYPES OF STRAIGHT AND OFFSET HOLDERS
STANDARD ELECTRODES

AND SPECIAL TO YOUR SPECIFICATIONS

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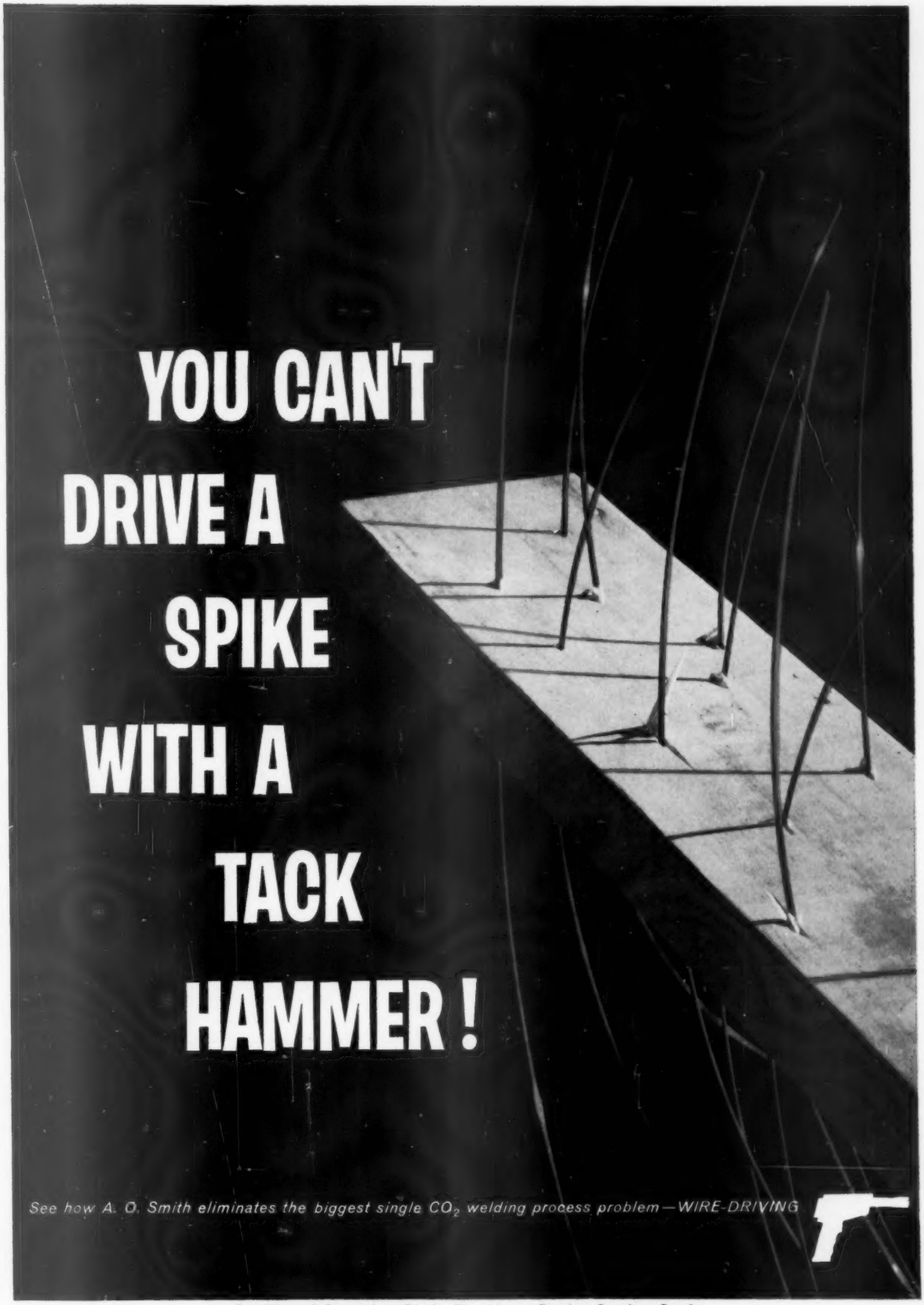

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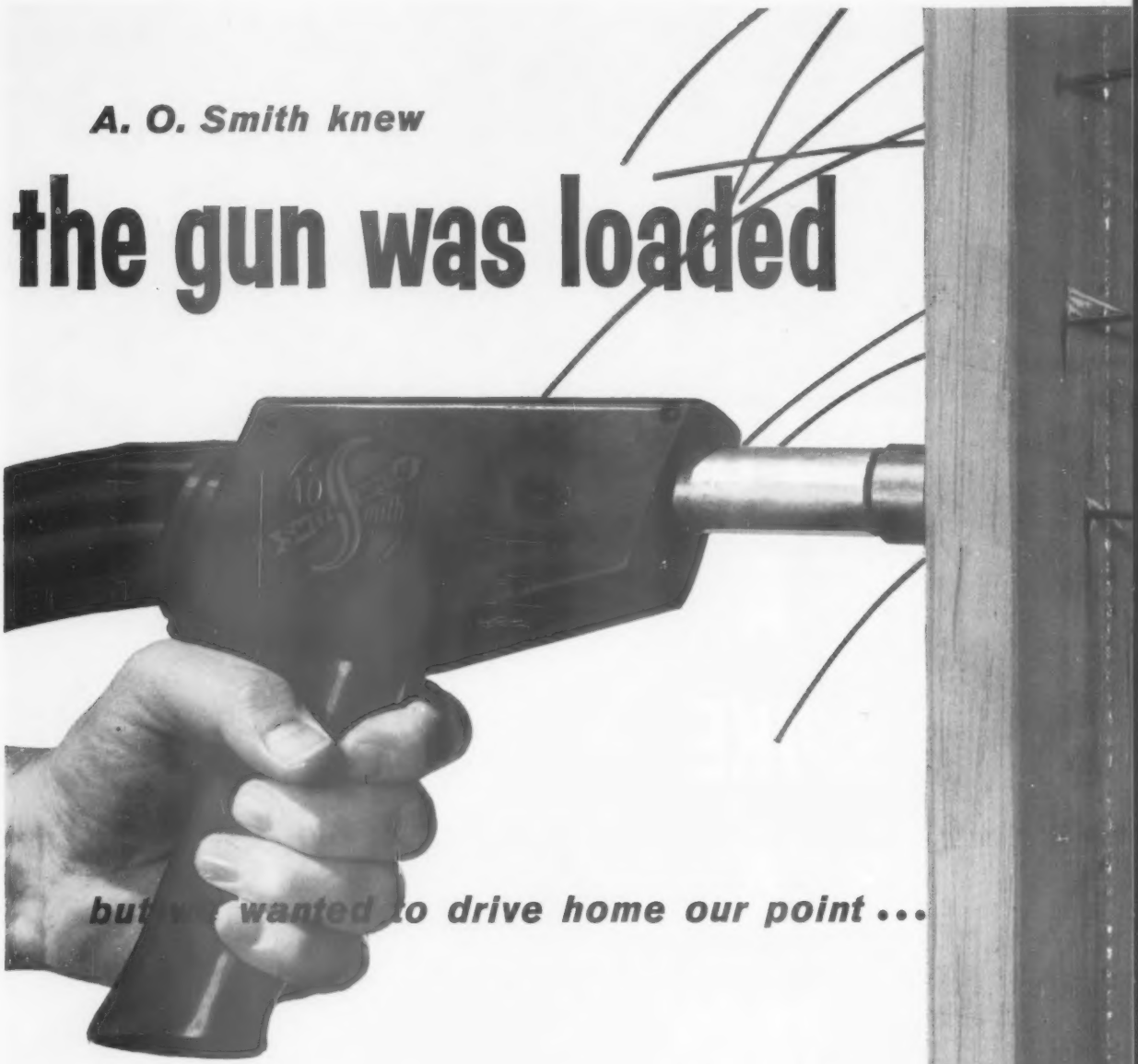
A. O. Smith knew

the gun was loaded



but we wanted to drive home our point . . .

that A. O. Smith automatic and semi-automatic welding equipment has more wire-driving "beef" than any other system in the field.

We drew a bead on a slab of wood with an A. O. Smith C-OMANUAL hand gun. The results were amazing — even to us. As you can see in the photograph, standard 1/16" diameter welding wire smashed completely through.

The same test was tried using the C-OMATIC unit with even more penetrating results. A. O. Smith's tested combination of control and wire-feeding system coupled with bonus horsepower drove the wire through an even thicker piece of wood. Positive proof of performance.

Try this convincing test at the National Metal Show — Booth No. 1446.

MADE BY WELDERS FOR WELDERS . . .

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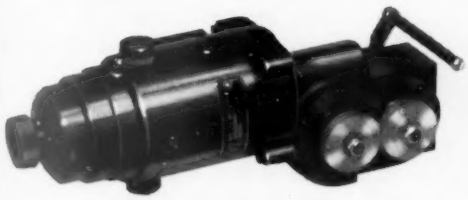
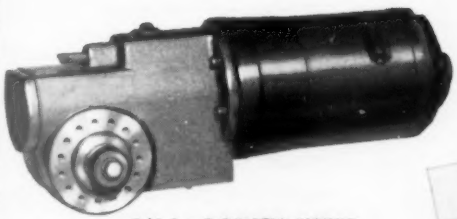
What does this test mean to you?

Just this! The same explosive power gets welding wire smoothly through the automatic head or hand gun. Let's face it. It is the inability of most CO_2 equipment to keep wire feeding continuously without lags and slowdowns that is causing the most trouble along production lines. A. O. Smith has met the problem with more *horsepower* — the biggest, huskiest, most powerful motor on *any* automatic or semi-automatic welding equipment.



1/5 hp C-OMANUAL MOTOR

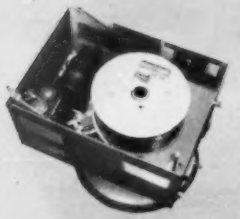


1/6 hp C-OMATIC MOTOR

MORE POWER — C-OMANUAL's big, rugged motor develops 1/5 hp as compared to only 1/12 and 1/10 hp on competitive semi-automatic equipment. Exclusive features include thermal overload protection and special oversized brushes. C-OMATIC's head and drive rolls deliver motor's full 1/6 hp with an exclusive 2-speed shift lever gear box providing low speed, high torque advantage.

WELDING IS OUR BUSINESS!

A. O. Smith has licked the small problems too!



MAINTENANCE PROBLEMS
Speed control on C-OMANUAL is mechanical. Can be serviced by your regular shop electricians.

GUN LEAKAGE PROBLEMS
A. O. Smith's cooler-operating, water-cooled hand gun drastically reduces spatter pickup and has no "O" rings. Water leakage has been completely eliminated.

ARC CONTROL PROBLEMS
Modern applications of the automatic or semi-automatic process require a range from over 40 to less than 20 volts. Only A. O. Smith gives such wide range plus the arc control features shown below.

- **Widest voltage range** available on any automatic or semi-automatic welding equipment — *0 to 45.4 volts.*
- **Stellarweld** direct-current reactor materially reduces weld spatter, especially at lower currents, makes CO_2 process practical with light-gauge material.
- **Slope control** permits any variation of volt-ampere curve from very flat to very drooping.

CRATER FILL PROBLEMS
Variable crater fill adjustments on C-OMATIC control panel are micrometer dial type — five times the range of any competitive pointer dial type.

For the complete story on A. O. Smith automatic and semi-automatic CO_2-shielded welding processes, write for informative booklet, "Who's Who in CO_2."

Through research A.O. Smith *... a better way*

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Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or technical assistance.

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NOVEMBER, 1959
Welding Design & Fabrication
ESTABLISHED IN 1930 AS INDUSTRY & WELDING

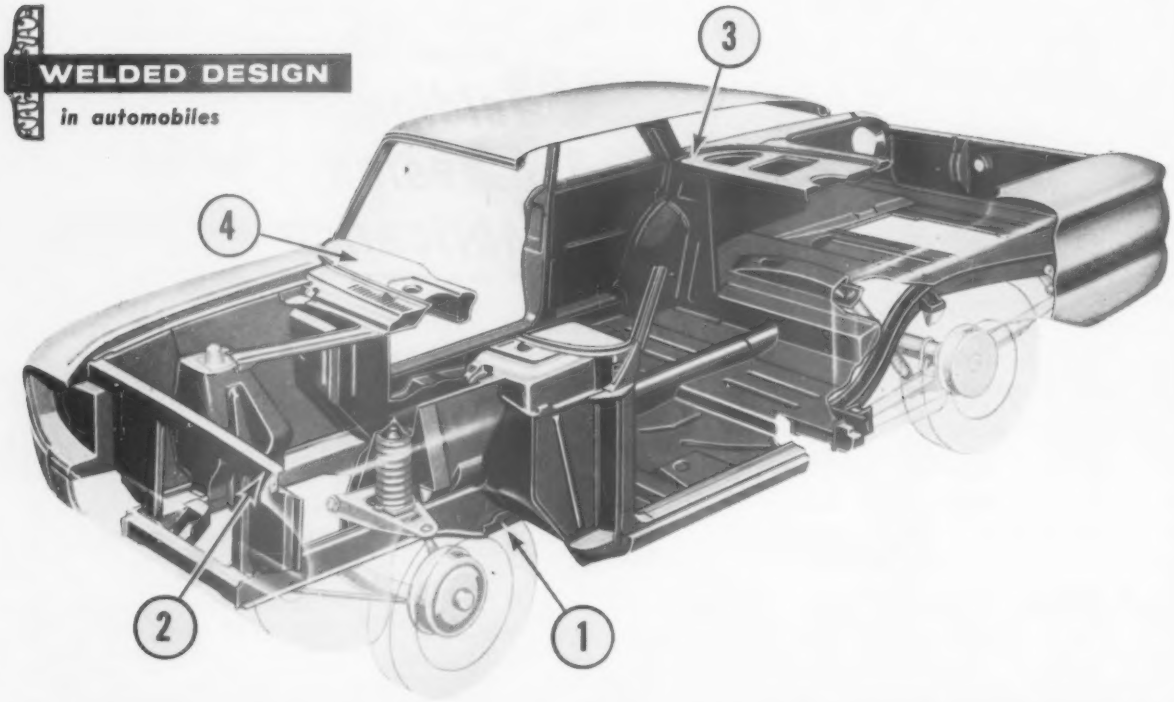
Case studies from 7 industries show . . .

WHAT MAKES GOOD DESIGN

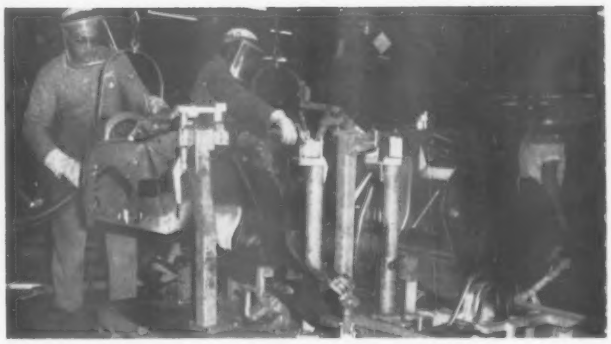
TODAY we must make two weldments grow where one grew before. In addition to the welding engineering and fabricating plant group, the welding industry must reach the designer, the man who decides that a product shall be welded—or bolted or forged or cast or riveted. We must teach the design group to weld products they never before thought could be or should be welded.

These case studies show what results when products are designed (or redesigned) for welded construction.

WELDED DESIGN
in automobiles



1 Operator spot welds fender apron subassembly (18-gage zinc-coated steel to 14-gage mild steel) with special gun.



2 Operators spot weld front fender apron and radiator support assembly in first station of a merry-go-round assembly line.

Unitized Welded Design Makes

IN BRIEF: Unitized welded design and good fabricating and welding techniques are combined to make a strong, high quality economy car.

SHOPPERS FOR AUTOS are now hearing more and more about unitized bodies. There's good reason. The body shell gives the car its strength and rigidity. There is no frame and few nuts and bolts. The body consists of mild steel parts. All are resistance spot welded, gas and arc welded into a single unit.

The Lincoln and the Thunderbird are unitized. Ford's newest, the Falcon, is too.

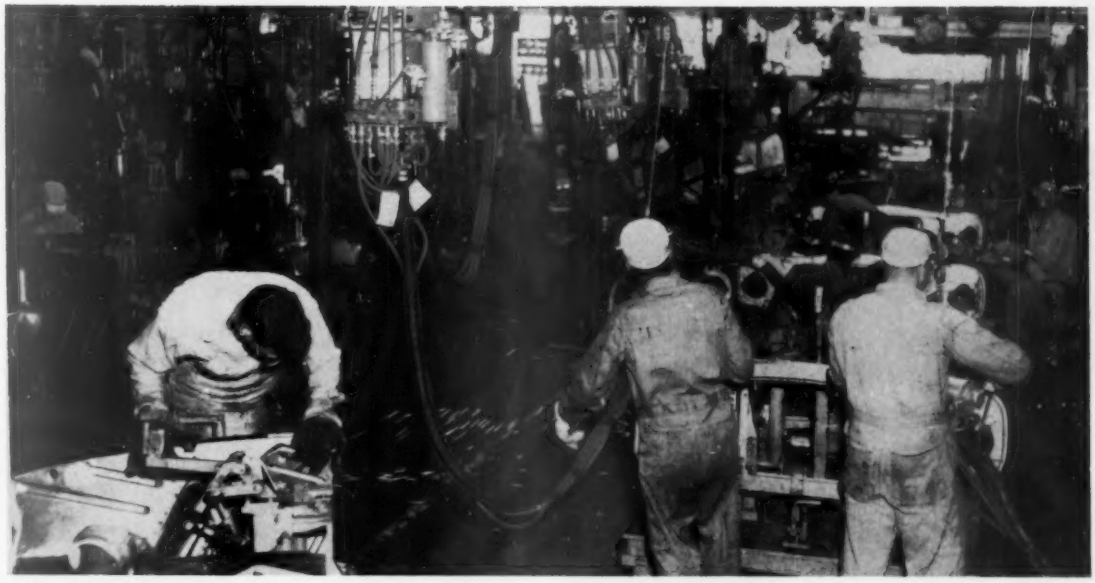
Here are some facts on the Falcon which Ford now is building at Lorain, Ohio and Kansas City:

The body contains 3,452 spot gas and arc welds. Structural parts are bolted, not welded, on. Makes them easier to replace.

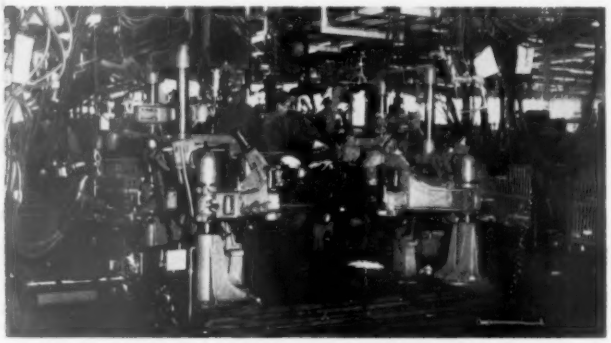
To prevent rust, especially from the salt spread on roads in winter, Ford uses zinc-coated steel for rocker panels and other structural members in this area. It may change a lot of thinking on the subject.

DESIGN

The heart of unitized construction is the underbody. It's a shallow boat of stamped steel, channeled lengthwise and crosswise by carefully spaced, strength-giving



ASSEMBLERS POSITION and secure front end subassemblies that start off the front end structure. Parts are added and spot welded in this oval-shaped merry-go-round that completes the front end structure units.



3 Car body takes form in body bucks; operators spot weld all major subassemblies together.

4 Operators spot weld dash panel while body moves along on dolly conveyor line.

A Stronger Body For Ford's Falcon

corrugations. It's reinforced on the edges by fold-overs that form hollow trusses and stiffened with welded structural elements.

Underbody joins two complete single units, welded side sections and roof top to form the complete body.

PRODUCTION

One operation of Ford's Lorain assembly plant is fabrication of the front end structure (see cutaway illustration). Ford puts all the loose components and welded subassemblies in precision fitup fixtures mounted on tables that rest on a conveyor-chain drive. The assembly line, called the merry-go-round is oval shape and has 10 identical fixtures. Assemblers load right and left sections. Locating pins and quick-acting toggle clamps enable the assemblers to position and secure parts fast, accurately and easily.

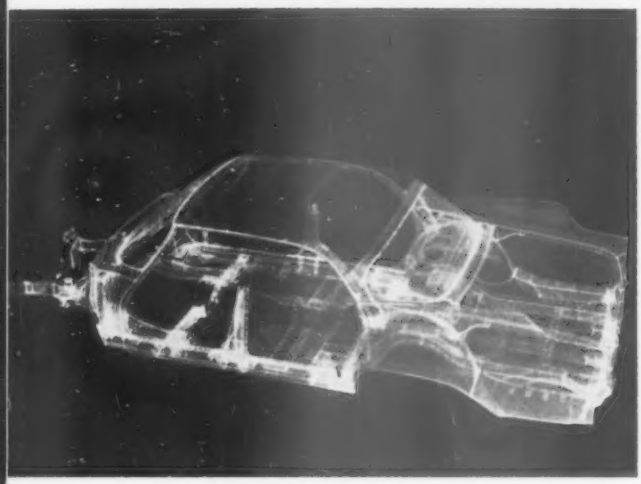
WELDING

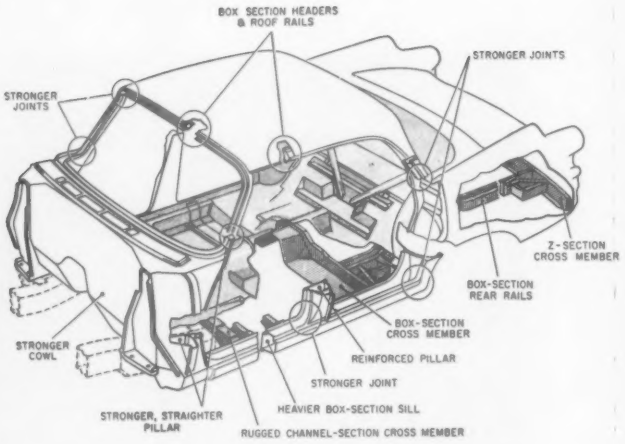
Ford uses spot welding like a sewing machine. On the front end alone they have 31 special spot welders hanging over the merry-go-round. Hanging makes the handling easier.

The new guns have double-acting cylinders. They give fast and accurate weld control at all times. Each is rated at 75 KVA. Each gun has two separate firing triggers—one for light and one for heavy gage metal.

continued on page 84

WELDED DESIGN
In automobiles





this plastic scale model helps Dodge design and build an all-welded, unit-constructed body in two years instead of five or six . . .

Dodge's Designers Pre-Test All-Welded Car Bodies On Plastic Scale Models

IN BRIEF: Plastic's deflection is proportional to steel and it is more elastic. This means Dodge can make nondestructive test on it and get the same answers that destructive testing gives on a full-sized welded steel model body.

A SHIMMERING TRANSPARENT plastic scale model of a car body saved engineers at Dodge Division of Chrysler Corp. years of testing time. They designed and built new unit-constructed Dodge Dart(and Dodge) bodies in two years instead of five or six.

Dodge used to use a full-sized steel model for all body structural analysis. It cost more, took longer to build. And, every time they changed the body, they had to rebuild the steel model. The plastic model is light, easy to handle and easy to work on. They change it quickly. Just cut out pieces of the plastic and put in new ones.

The scale used in the model (⅜-inch equals one-foot) is followed closely. Even the plastic thickness is held to scale in areas where compound curves or die forming changes the thickness of the panels.

Plastic model parts are formed with heat and a vacuum. Pattern experts first make wood scale models from advance blueprints. In the pattern, they drill many small holes that lead into a central vacuum line. Put heated sheets of rigid vinyl plastic on the patterns, turn on the vacuum pump and the sheet is pulled into the exact shape of the pattern.

SIMULATE WELDED JOINTS

Once formed, they assemble the parts the same as in a full-sized assembly. Where spot welds are to be made on the full-sized car, the model maker uses a miniature electric spot welder to fuse the plastic panels. To simulate an arc weld, the model maker uses an electrically-heated gun to melt a thin plastic rod and flow it into the seam. This produces exactly the same joint as a full sized arc weld.

SIMULATE LOADS AND STRESSES

The plastic model can be loaded to simulate the

continued on page 101

New, high-tensile steels require
special care when welding.

Submerged arc welding gives the most reliable
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most conventional, submerged arc equipment is
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That's why Peabody Coal Company used a
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Mechanized "Squirt" simplifies T-1 steel fabrication...

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MEET M&T's

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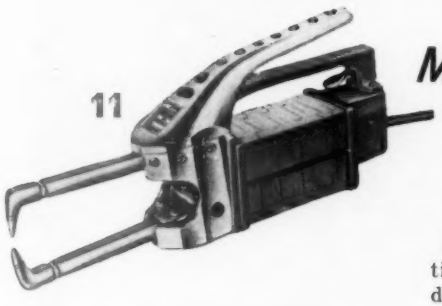
NEW LINE



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ALL NEW! And you'll find everything here from heavy-duty production machines to portable small shop outfits. Many have unique design features. All are made to equal or exceed the most rigid industry specifications. And all are manufactured with the same careful attention to quality you see in the line of Murex rotating welders and controlled arc power sources which are also available.

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6. **AC Arc Welders** complete, portable welding outfit
7. **High Frequency Arc Stabilizer** for metallic arc welding
8. **High Frequency Arc Stabilizer** for inert gas arc welding
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10. **Arc Torch** for use with any DC or AC welder
11. **Portable Spot Welder** for sheet metal and wire

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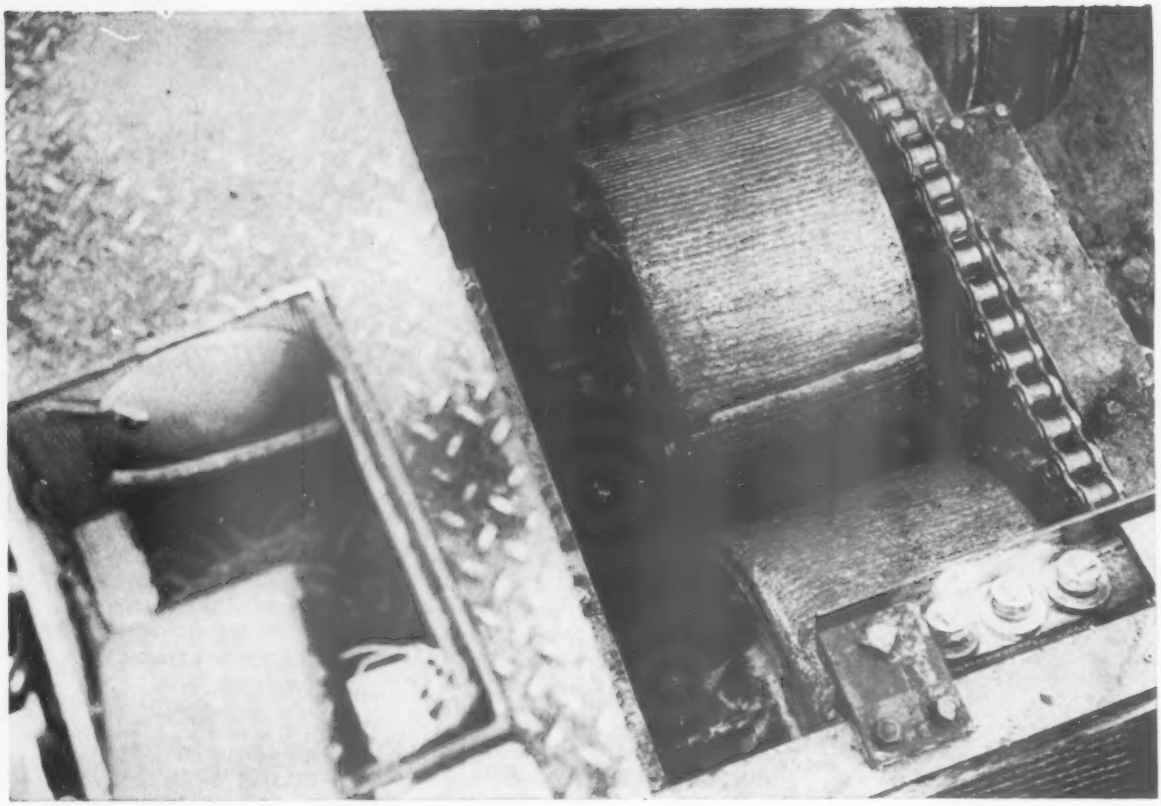

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Stoody Semi-Automatic wires are available in a variety of alloy types for all job requirements. They can be fed through most standard semi-automatic welding machines.

Near Grants, New Mexico, a new super highway is under construction. Keeping crushers in operation to supply aggregate is a tough job. Roy Hartman, the welder, states, "I like to hard-face with the Semi-Automatic machine. On crusher rolls, I can lay down from 7½ to 10 pounds of Stoody 100 per hour but only about half that much when applying manual electrodes—even though working hard. Semi-Automatic hard-facing makes my job easier."

To lick the toughest jobs fast, with less wear-and-tear on yourself, just try Stoody Semi-Automatic Hard-Facing. A variety of alloy types cover all hard-facing requirements. If you'd like a demonstration in your own plant on your work, simply ask your nearest Stoody Dealer (see the "Yellow Pages" of your phone book) or write direct to the company.

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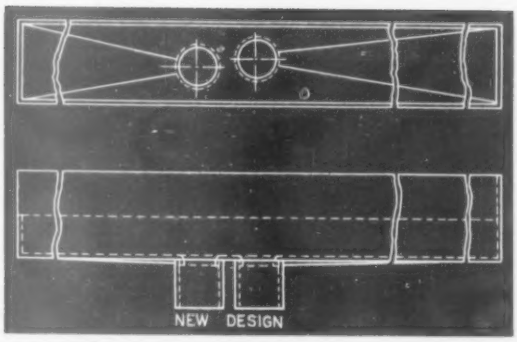
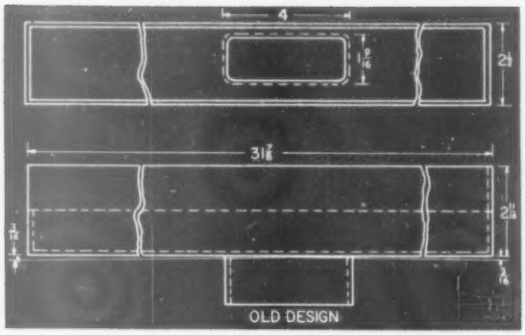
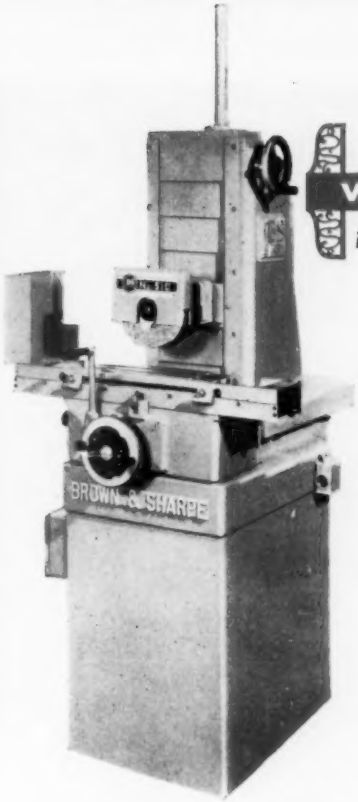




DISTORTION PROBLEM in a welded wet grinding table trough for a new surface grinding machine was eliminated by redesigning the part.



WELDED DESIGN *in machine tools*

Redesign Eliminates Straightening And Grinding; Weldment Cost Is Cut 50%

by **HUGH J. WILSON,** *Mfg. Engineering Dept., Machine Tool Div., Browne & Sharpe Mfg. Co.*

IN BRIEF: Members of Brown & Sharpe's engineering, fabrication and design departments team up to beat a welding distortion problem.

OUR FABRICATING DEPARTMENT had to find a way to avoid distortion. It was in the wet grinding table trough for our new No. 510 surface grinding machine. We spotted the trouble when we made the first pilot model with a wet grinding attachment.

PROBLEM

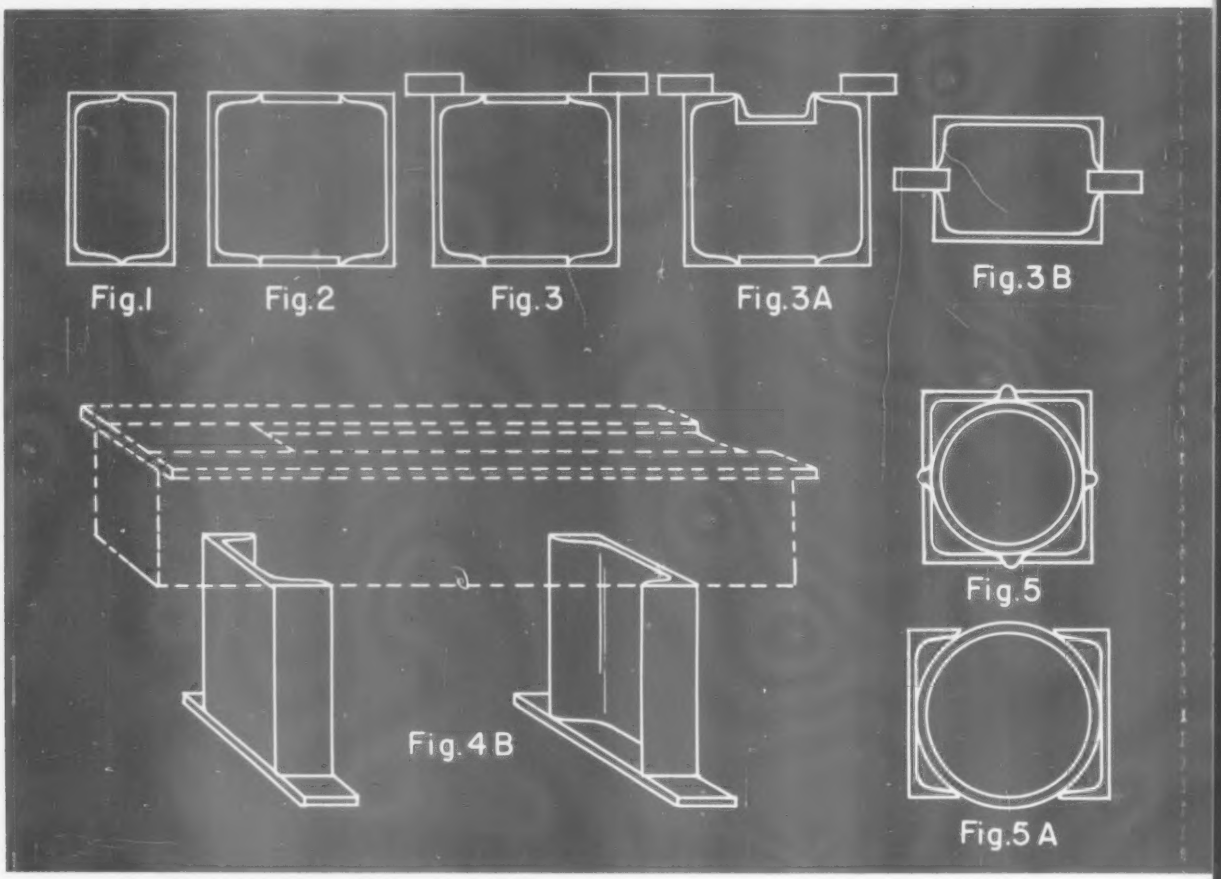
The 1⅝- by 4-inch opening in the old design required about 11¼-inches of welding. The 3/16-inch taper from each end to the center required a fabricated joint front and rear. Because of the trough's location, we had to finish grind all welds before painting. The large amount of welding in the center section twisted the trough, which then had to be straightened by hand. Grinding took a long time because the welds around the chute and the front and rear seams were hard to get at.

We could have avoided the distortion by making a welding fixture to keep the welded joints cool. However, that would not have cut costs. So, we kept at it until we found a way to do the job for less money. The key was to redesign.

SOLUTION

We asked a member of our Manufacturing Engineering Department for help. He worked with the fabrication foreman and the design engineer. Together, they discussed improvements in the pilot lot design. They worked on several ideas before they agreed on the final design.

The new design got rid of the fabricated joint front and rear. And, we make a cross bend in a press brake to get the 3/16-inch taper we need. We changed the center chute by pressing a flange on two holes and tack welding two pieces of tubing to the trough. This got rid of the excessive heat in the center of the part. Once rid of the distortion and the need to straighten and grind, the cost of the part fell by half. • •



Standard Structural Shapes Can

by **A. E. DOROD**, *production manager, Cecil C. Peck Co., Cleveland, Ohio*

IN BRIEF: Extremely rigid sections can be made economically by welding various combinations of channels, I-beams, H-columns, angles, tubes and plate.

USING STANDARD STRUCTURAL steel shapes in machine bases can cut manufacturing costs appreciably. Why? It's cheaper than using fabricated plate. There's less flame cutting, bending, splicing and seaming. How? Make rigid sections by using various combinations of channels, I-beams, H-columns, angles tube and plate. For example, you can use two channels to make a column, ram, rail or base. Just put them flange-to-flange (Figure 1) and make two welds. These can be varied in size. The only limit is the size and weight of available channels. Where there is enough production, these seams can be made automatically using an outside or an inside weld. The latter eliminates grinding if appearance is important.

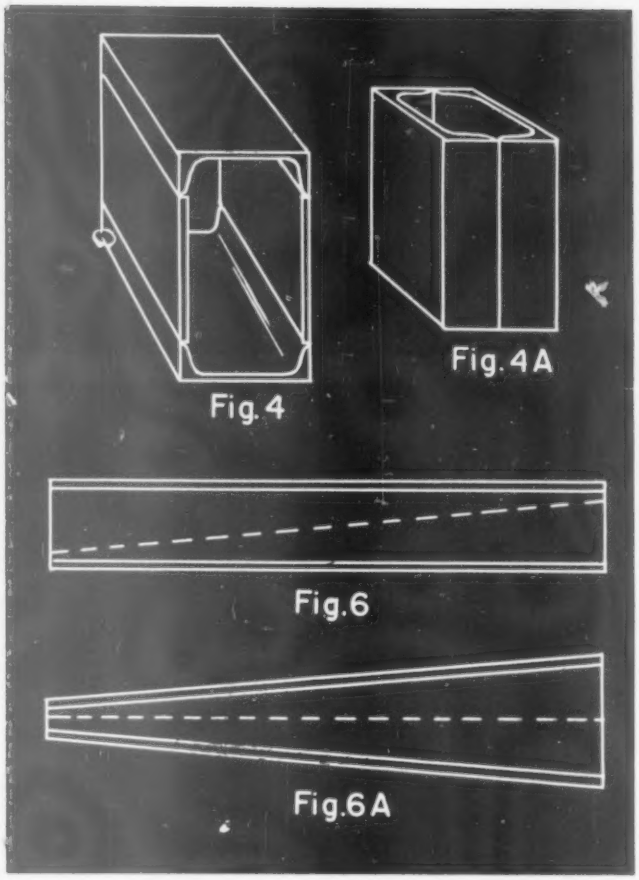
Where the width of the section required is beyond the range of available shapes, the addition of two flat plates needs only two additional seams (Figure 2). Any number of stiffening braces can be added as required. Position and weld them into place before adding the top plate.

Movable units are sometimes required on such a base. If they are, weld two ways into position using the skip weld method (Figures 3, 3a and 3b). Then machine finish them.

Add a pair of legs if you want to raise the unit off the floor. Make these legs or pedestals from individual channel sections (Figures 4 and 4a) or from channels and plate (Figure 4b).

Add a bottom plate or ears for anchoring.

You can make one of strongest sections that can be made from structural shapes when you use a steel tube with angles or channels (Figures 5 and 5a).



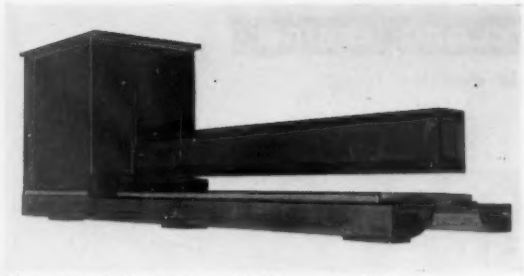


Figure 7: Machine base with three extended arms.

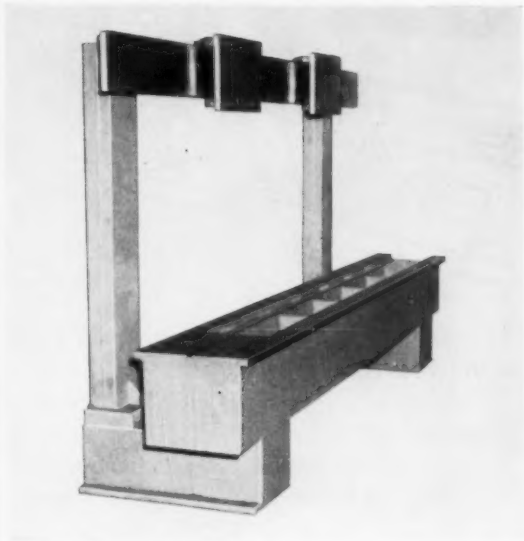


Figure 8: Built-up base section.

Simplify Design Of Machine Bases

This section has good resistance to torque. The angles or channels can be solid or skip welded.

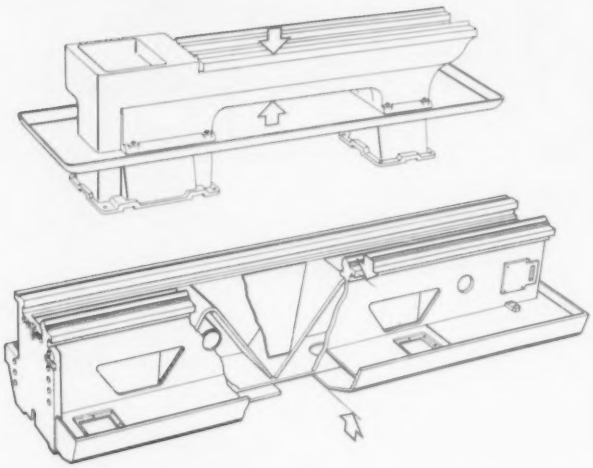
Sometimes channels are needed with a wider web sections at one end than at the other (Figures 6 and 6a). Don't shear plate and make four seam welds. Instead, flame cut a channel of proper size on the diagonal, reverse one end and reweld. This makes a section stronger than welded plate.

A machine base with three extended arms is shown in Figure 7. The lower arm is made of 1½-inch plate; the two upper arms are made of 1¼-inch plate bent at 45° and welded to an unequal leg angle. This is the base section of a seam welder that clamps the two edges of a tank in welding position. Extreme rigidity is needed from one end to the other.

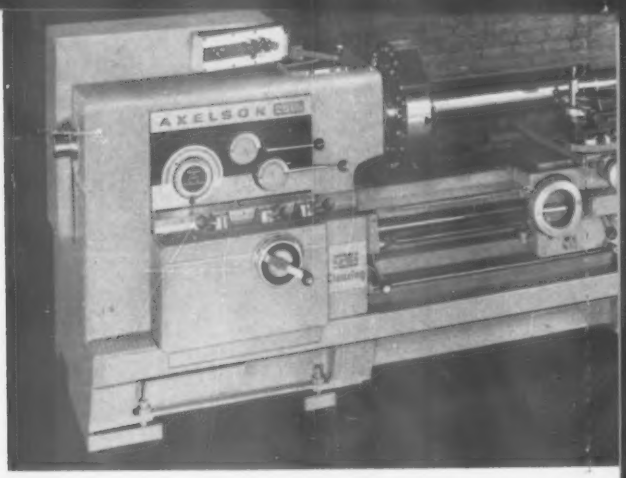
A built-up base section with legs and vertical columns supports an upper beam and welding head carriages (Fig 8). The verticals are made of two channels welded flange-to-flange. The ways that carry the head and tail stocks are shown on the base along with cross-bracing webs. The upper beam is mounted on the vertical sections by two plates with finished surfaces together and bolted to the beam at each end. This beam is positioned squarely in relation to the ways. At each end the back block of the two is welded to the verticals. This assembly method can save hours. Beam can be removed and always replaced in exact alignment.

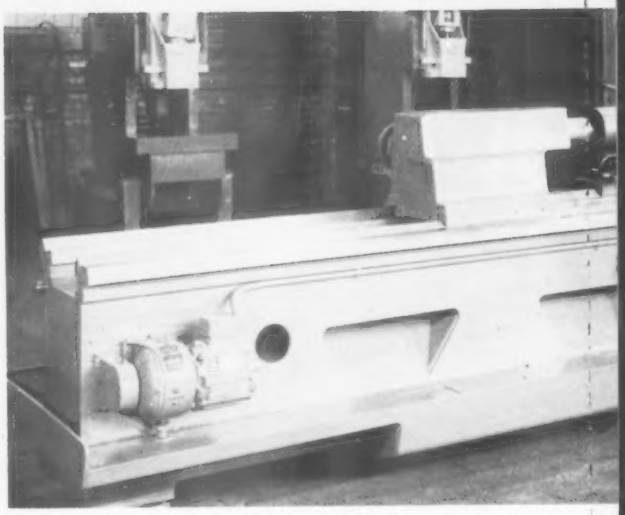
turn to page 83 to see how standard structural shapes, like square tubing and channels, can be used to make brackets and head and tail stocks

WELDED DESIGN
in machine tools



Top: Conventional lathe bed. Bottom: Welded bed has extremely thick, wide flange for rigid mounting to the headstock. Ribs form a series of pyramids for added stiffness and to act as chip chute walls. Those are some of the reasons . . .





TOP: Extending lines of chip-coolant pan face across the front of the headstock and picking up the continuity of the bed ways above the gear box gives an integrated look when the all-welded

Welded-Steel Design Makes New Lathe Stronger, Lighter, More Economical

by **J. M. LITTLE**, *J. M. Little & Associates, Maumee (Toledo), Ohio*

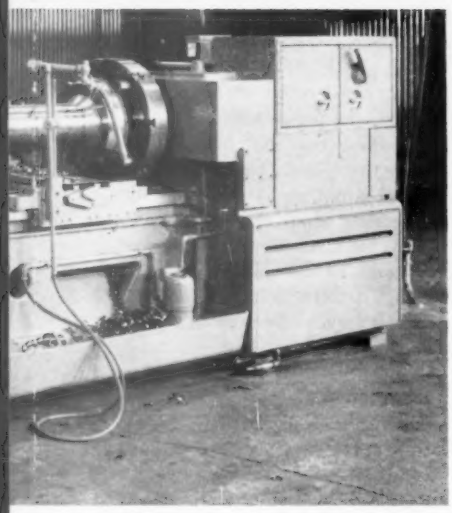
IN BRIEF: The use of welded design in machine tools is not new. However, this lathe represents the first use of welded design for a line of standard engine lathes, planned for quantity production.

MANY OF US can remember the old, ornate lighting fixtures with cast brass "tassels" that were poor imitations of the genuine fabric articles. One can recall and see today, similar examples of initiative designing.

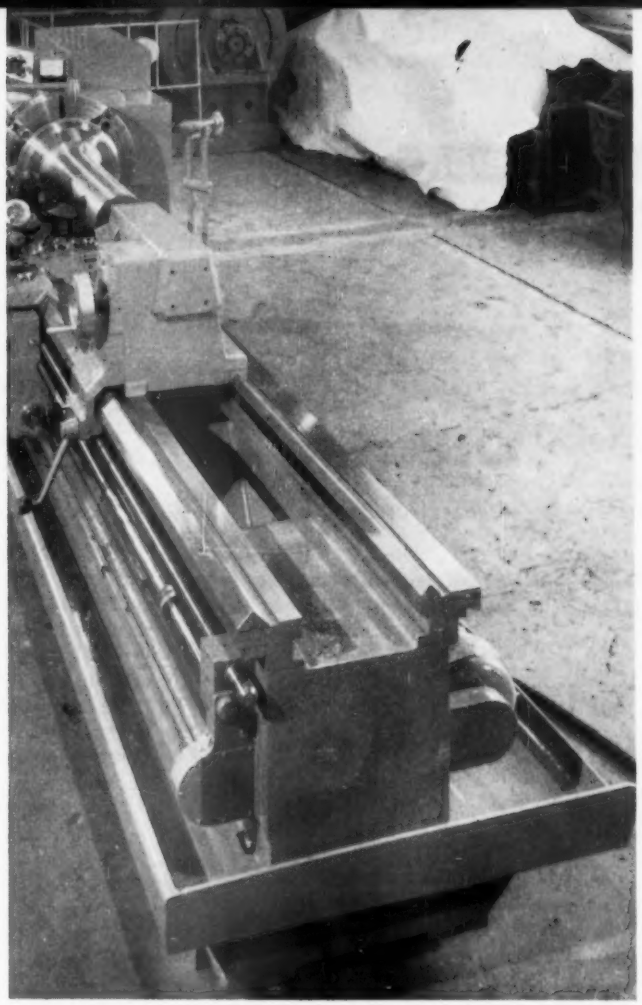
Fondness for the past is carried irrationally into the present. To design for present needs with the latest materials and methods, we must divorce design thinking from irrelevant, past associations. How? Approach each problem without preconceived notions. Some automobile makers put needless whipsockets on their horseless carriages to retain some of the secure past. Today, designers still apply old forms to new materials.

IMITATION IS EXPENSIVE

Although welding has come of age as a production process, too many designers are still unaware of its advantages—and its disadvantages. Castings are converted to weldments without basically changing their



headstock is attached to the welded bed. **BOTTOM:** Rear view shows pyramid-shaped bed sections that form chip chutes.



EVEN THE CHIP PAN adds to the rigidity of the entire lathe. Built to the floor, the bed utilizes the extra-thick integral pan to get added strength.

shape or configuration. The "soft" radii and lines of good casting practices are applied. However, casting requirements applied to weldments are not only needless, but they are detrimental. Costs and appearance suffer. To imitate what was done in cast shapes and ball corners calls for expensive hand work on the welded pieces. And, the designed-for-casting weldments looks as insincere as the cast brass tassel.

When my company was retained by Clearing Division of U. S. Industries to collaborate on a new concept in lathe design, we were well versed in the traditional machine design problems. Because of our experience as industrial designers and consulting engineers, we could contribute an unbiased design attitude to Clearing's fresh engineering approach.

Experienced in all-welded steel construction of hydraulic and mechanical presses, Clearing's engineers had the task of redesigning the Axelson lathe. The greater structural rigidity of welded steel was apparent. Other objectives? Greater available spindle speed range, increased horsepower, unitized control and power elements, modular construction. These requirements were more or less met by a test model at the time we were called in.

NEED FOR AN INTEGRATED LOOK

One of the strong points of the new Axleson lathe is that its welded bed can be detached from the all-welded headstock. This means bed length can be varied at will. However, this unitized construction was all too apparent in the test model. The effect was

continued on page 82

ABOUT THE AUTHOR: J. M. Little has been an industrial designer for 25 years. Often called a pioneer in this field, he has lectured on industrial design at various colleges and universities.

Formed in 1943, J. M. Little & Associates does industrial design and engineering consulting work. Three of the firm's award-winning designs were shown at the International Council of Societies of Industrial Design Stockholm exhibit in September. This exhibit is scheduled to tour Europe and this country.

WELDED DESIGN
in pressure vessels

Practical Hints On Designing And Ordering Welded Pressure Vessels

by **ROBERT CHUSE**, *Leonia, New Jersey*

IN BRIEF: The designer and fabricator of a pressure vessel must know how it is to be used, what chemicals will be used in it and the rate of corrosion, if possible.

THE RELIABILITY of a pressure vessel depends on the foresight of the ultimate user and the information he gives to the designer and the fabricator. This information should tell how the vessel is to be used and what chemicals will be used in it. If possible, the rate of corrosion should be given. This is usually based on the history of vessels in similar service.

Corrosion resistance data is available about most materials and chemicals, even if the vessel and the material from which it is made are new to a corrosive process. But, actual operating conditions can seldom be duplicated in the laboratory. Frequent close examination should be made of the vessel after it is placed in service. This is the way to determine what is actually taking place inside the vessel.

DESIGNERS NEED FACTS

In most cases no one but the user is familiar with the operating conditions of the vessel and the causes of defects and deterioration in the type of vessel he is ordering. The user should give all the facts to the designer. With this information, the designer will be able to use a material best suited for the service, place openings in the most desirable locations and provide inspection openings to permit examination of inside surfaces.

Most vessel users do not have an inspection staff of their own. They are grateful that the A.S.M.E. Code exists. It gives them an accepted standard of construction and impartial shop inspection. Therefore, they order a vessel to be constructed according to the A.S.M.E. Code. This Code permits many types of construction. Some of these may not be suitable for the service intended for the vessel. Therefore, just ordering an A.S.M.E. vessel is not always the answer. For example, the Code permits small openings to be welded from one side only. It also allows offset construction of girth seams and heads. While suitable for some uses, this type of construction may not be suitable for your purposes. It leaves some inside seams and fittings unwelded and open to corrosion.

BE SPECIFIC WHEN ORDERING

As a purchaser, you should be aware of these facts. Be specific when ordering a vessel. Specify the type of welded joint you want. Check the drawings before fabrication to make sure the welded joint is the type you want, the openings are where you want them, and the inspection openings are positioned for easy access to the inside of the vessel.

The Code inspector will check the vessel's design to make sure the shell and head and nozzle thicknesses are correct, the knuckle radius is sufficient, the openings are properly reinforced and the flanges are thick enough. But he is not concerned with the position of the outlets as long as they comply with the Code.

Internal corrosion generally develops on surfaces where moisture collects. For this reason it is important that you make sure the vessel can be drained properly.

In vertical vessels equipped with agitating devices, the greater wear is usually found on the bottom head. In horizontal vessels with agitators, the most wear will be between six o'clock and nine o'clock positions when rotation is clockwise. When rotation is counter clockwise, the wear will be between the six o'clock and the three o'clock positions. Take this into consideration when designing a horizontal vessel with an agitator. Design the vessel to permit turning it. In this way the thinned out area can be rotated to the top half. The useful life of the vessel is extended when you do this.

ALLOW FOR CORROSION

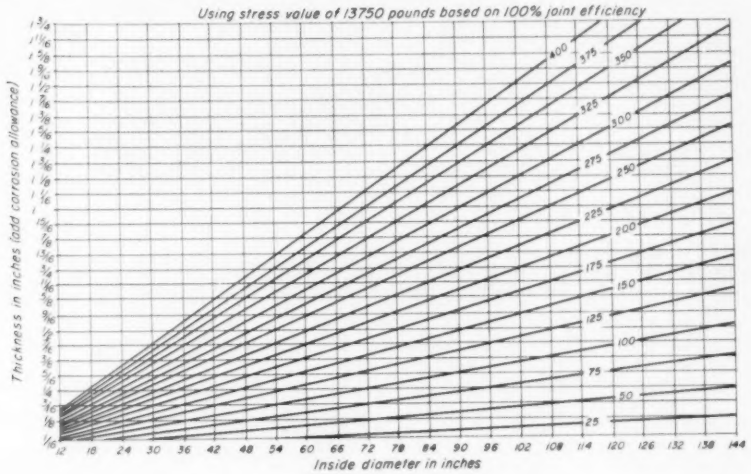
Extra corrosion allowance should be considered

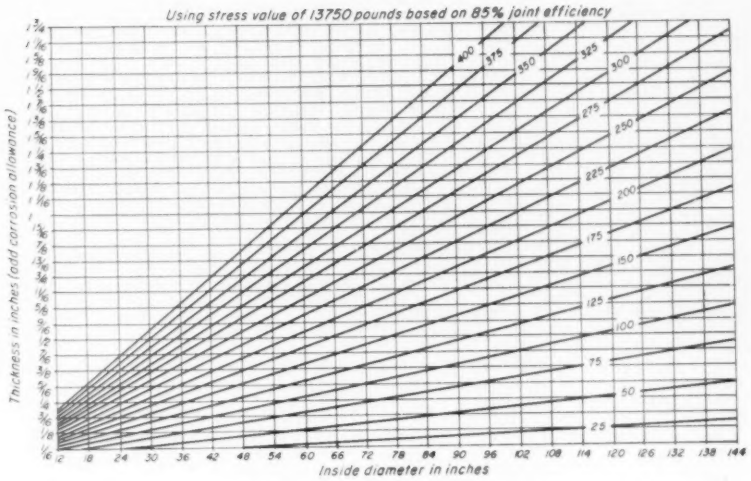
text continues on page 80

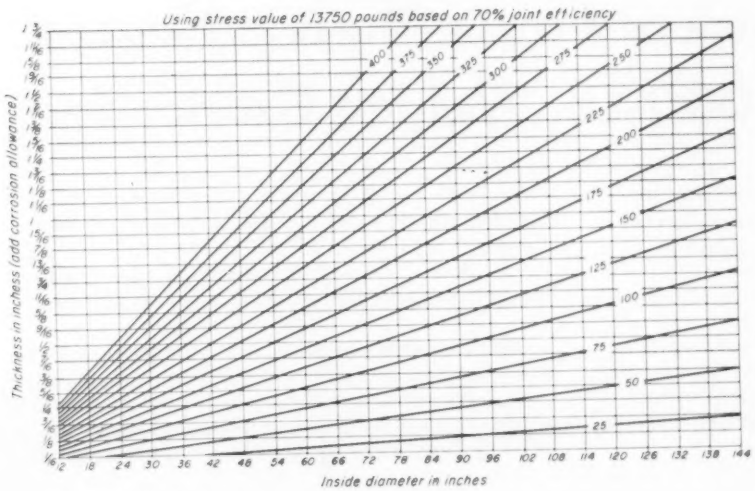
ABOUT THE AUTHOR: Robert Chuse is the author and publisher of a privately circulated book entitled "The Unfired Pressure Vessel Code Simplified." The charts on the opposite page are adapted from a supplement to that publication.

Mr. Chuse graduated from Pennsylvania State Nautical School in 1930 where he studied Marine Engineering. After graduation he worked as an engineering officer in the U. S. Merchant Marine. He came ashore in 1936. Since 1941 he has been reviewing designs and inspecting pressure vessels and boilers according to A.S.M.E. Codes.

use these to determine wall thicknesses for cylindrical shells


Using stress value of 13750 pounds based on 100% joint efficiency
Thickness in inches (add corrosion allowance)
Inside diameter in inches


Using stress value of 13750 pounds based on 85% joint efficiency
Thickness in inches (add corrosion allowance)
Inside diameter in inches


Using stress value of 13750 pounds based on 70% joint efficiency
Thickness in inchess (add corrosion allowance)
Inside diameter in inches

A. S. M. E. Code Changes Welded Joint Efficiencies

The March, 1959, addenda to the A.S.M.E. Unfired Pressure Vessel Code, Section 8, contains major changes in the welded joint efficiencies. The Code now allows 100 percent efficiency for double welded longitudinal butt joints that are fully radiographed. Joints that are spot radiographed have 85 percent efficiency. Joints that are not spot radiographed are rated 70 percent efficient.

For carbon steel vessels that are to contain air, steam or water, a corrosion allowance (as required in Par. UCS 25) must be added to those vessels that are radiographed or spot radiographed. This requirement does not apply to those vessels that are not spot radiographed.

Also new in this addenda is the fact that no increase in welded joint efficiency is allowed for a vessel where the welded joint is sectioned, or for vessels that are stress relieved.

Figure out the thickness required by following the diameter line up to the pressure line, then horizontally to the left side and reading the thickness value. These charts are based on the following formula:

$$t = \frac{PR}{SE - 0.6P}$$

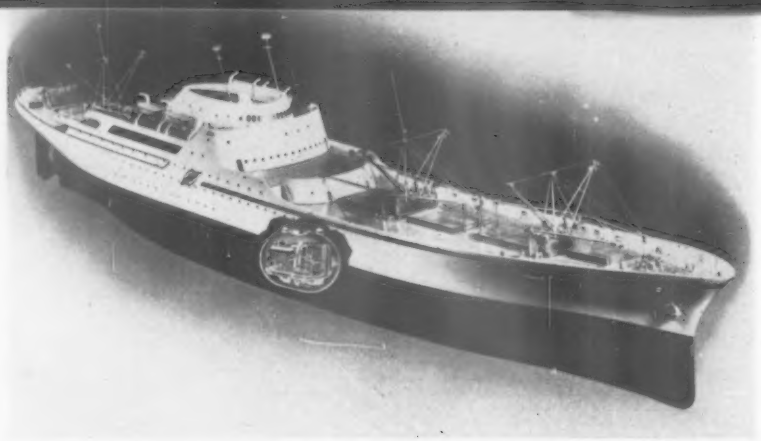
where:

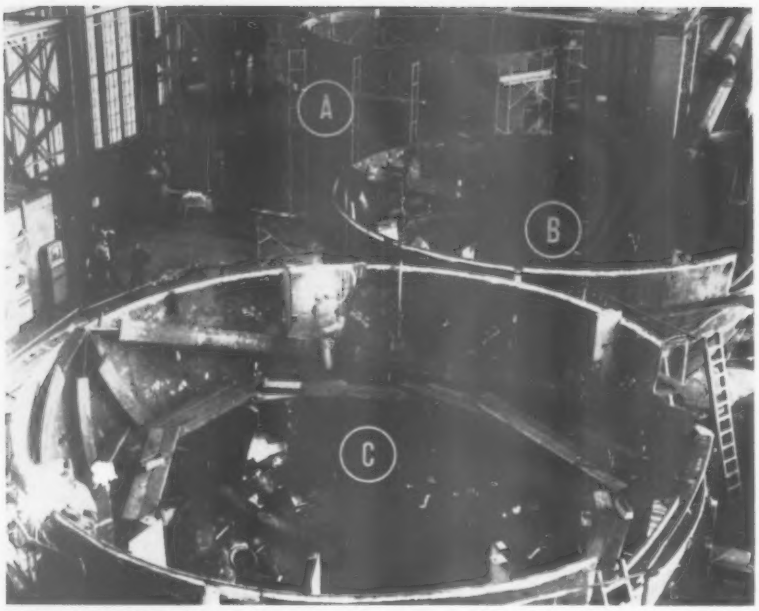
t = thickness
P = internal pressure
S = allowable stress (13750 lbs.)
E = efficiency of joint (70, 85 or 100%)
R = inside radius

For stress values other than 13,750 lbs. allowable stress multiple chart thickness by the following constants:

11,250 lbs. by 1.222
12,500 lbs. by 1.1
15,000 lbs. by .9167
16,250 lbs. by .846
17,500 lbs. by .7857
18,750 lbs. by .733

WELDED DESIGN *in merchant ships*





NUCLEAR POWER PLANT (see cutaway) is contained in 250-ton shell being fabricated (above). Containment vessel consists of a center cylindrical section (A) and two hemispherical heads (B and C). (Photos courtesy Babcock & Wilcox and Metal & Thermit Corp.)

by **HENRY LEFER**, *eastern editor*

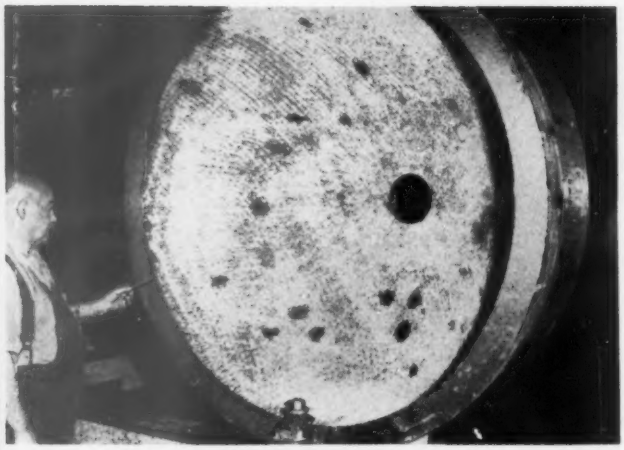
Savannah's Nuclear Power Plant Is Housed In A 500,000-Lb. Welded Fabrication

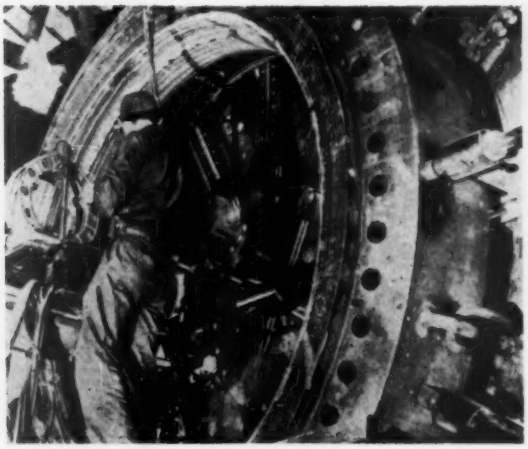
IN BRIEF: A 500,000-lb. steel shell houses the entire reactor plant and the primary cooling system for the N. S. Savannah, the world's first nuclear-powered merchant ship.

A 500,000-LB. WELDED steel shell houses the entire reactor power plant and primary cooling system of the *N. S. Savannah*. The world's first nuclear-powered merchant ship, it was recently launched at Camden, N. J.

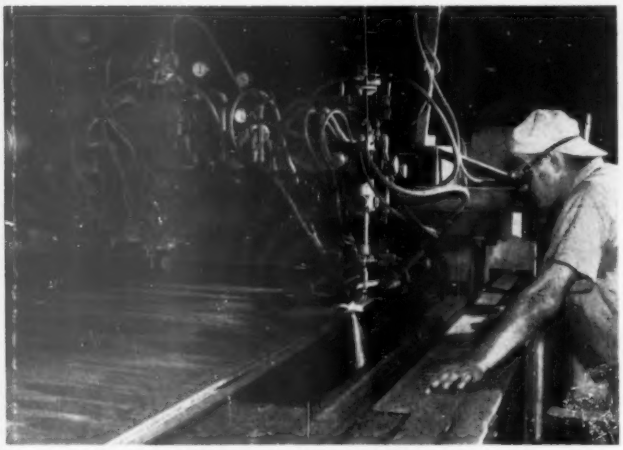
The shell had to be welded, says Ralph Bradway, Hull Department welding engineer of New York Shipbuilding Corp., which built the *Savannah*. According to Bradway, welded fabrication gives the greatest strength and assurance of absolute pressure-tightness with the least weight.

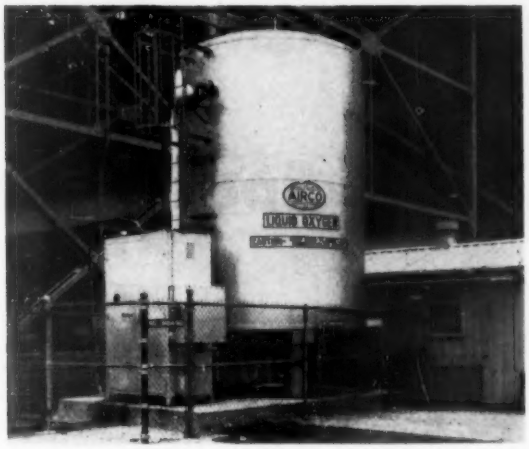
This containment shell is the outermost of several protective layers, It is about 51-feet long. It consists of two hemisphercial ends (1¼-inches thick) and a center cylinder (35-feet in diameter, 16-feet long and 2⅜- to 3¾-inches thick). SA-212 Grade B carbon-





HEAD OF REACTOR VESSEL (left) is welded to flange (right). Flange-head assembly is then bolted to the reactor vessel with 48 350-lb. bolts and 50-lb. nuts. (Photo courtesy of Babcock & Wilcox Company.)





SPECIAL BEVEL-CUTTING MACHINE (left) is among the flame cutting machines used. Permanent bulk liquid oxygen installation (right) supplies various cutting stations. (Photos courtesy of Air Reduction Sales Co.)

silicon steel is used.

Just within the shell is a secondary shield. This consists of water, concrete, lead and polyethylene. This in turn surrounds the primary shield: an inner cylinder of water (33-inches thick) and an outer cylinder of lead (from one- to 4-inches thick). The kernel of this many-layered nut is the reactor itself. This is surrounded by a 105-ton reactor vessel made of 6½-inch steel plate.

In case of a rupture in the reactor vessel, the containment vessel seals in escaping radioactive steam and water.

All welding on the containment vessel was done manually. Type E-7016 low-hydrogen, all-position welding electrodes from ⅛ to ¼-inch in diameter were used with DC rectifiers and a constant-potential resistor-box set-up. It's estimated that a total of 600,000 lbs. of electrodes will have gone into the *Savannah* by the time it glides into service.

The steel plates for the containment shell sections were flame cut in the shipyard's plate and angle shop. So were the bevels. Oxygen was piped directly to the various stations from a permanent bulk liquid oxygen station.

Root passes on 60° double-Vee butt welds used were checked by magnetic particle inspection. Joint areas were preheated with electrical strip heaters. After welding, all butt welds were radiographed. All fillet welds were inspected with magnetic particle equipment.

On completion, each section of the shell was stress-relieved in a furnace. The three sections then went to final assembly in place on the ship. Then hydrostatic testing was done at 173 psi.

The reactor vessel is made of SA 212 Grade B steel plate. However, the surface which is to become the inside is clad with 0.109-inches of SA 240 Grade 5 stainless steel. The vessel consists of two hemispherical

continued on page 80

WELDED DESIGN
in rockets and missiles

Ryan Aeronautical has to build super-strength rocket chambers. The company's designers and engineers found . . .

SUPER-STRENGTH, tissue-paper thin steel spirals slowly onto this mandrel where it is tack welded into position.

Spot Welded Paper-Thin Steel

IN BRIEF: Spot welding multiple layers of foil-thin stainless steel strips is the best way to contain the explosive forces developed in rocket motors.

STRONG ROCKET CHAMBERS that withstand 305,000 psi wall stress are being built by Ryan Aeronautical Co., San Diego. These light weight chambers are made by a new "strip-winding" method in which multiple layers of foil-thin steel strips are spot welded together.

Ryan has built and tested a varity of quarter-scale rocket motors and is adapting this research—in which strengths obtained are much higher than in solid wall cylinders—to full-scale rocket motor requirements.

TECHNIQUES

Obtaining this high strength required the solution of major problems. One was the reduction of stress concentrations around the spot welds. This was done by improving welding techniques. With these new techniques, Ryan welds together as many as 20 layers of thin gage material.

These new techniques overcome a major hurdle in rocket chamber construction: attaching and closures. 17-7PH stainless steel end closures welded in place with the new Ryan method successfully withstand the 305,000 psi stress.

In addition to using stainless steels, Ryan plans to build at least one sub-scale model chamber from titanium.

The Ryan technique of spot welding together many layers of foil-thin stainless is the best method of containing the explosive forces developed by rocket motors. Two other methods have been tried; neither was suitable. Brazing the layers together introduces extra weight; high temperatures used in brazing weaken the parent metal, according to Ryan. Resin bonding doesn't work well, either. The layers separate when they come up against high temperatures.

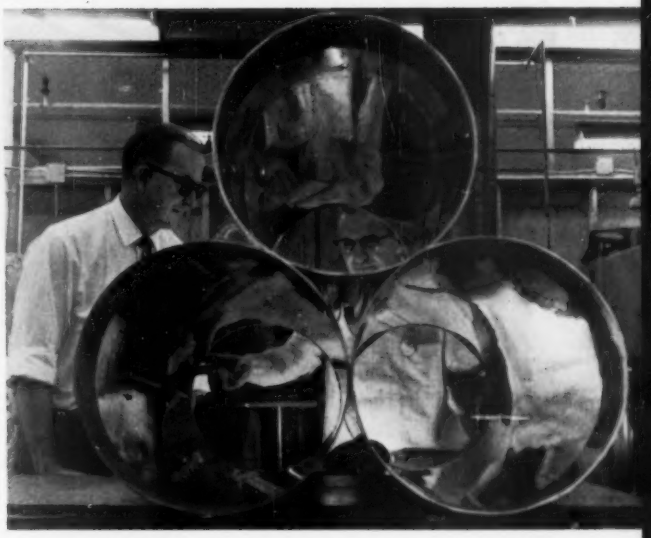
MATERIALS

Ryan needed a material that would meet all the conditions. They tested 17-7 PH stainless, 301 (extra full hard), AM355 (sub-zero cooled cold rolled and tempered stainless in both 30- and 70-percent cold reduced types), HS-25, PH15-7Mo and AM355 (cold rolled and tempered). Ryan is currently testing AM 355 (cold rolled and tempered extra hard). This was not available when the other metals were being examined.

TESTING TECHNIQUES

Ryan engineers made two-ply spot welded specimens from each of these alloys. Specimens range in width from 0.300- to 0.750-inches. The number of spot welds varies from one at the center of the strip to overlapping spots across the entire width.

POSITIONING GUIDE is mounted on cylinder to get precision spacing of spot welds.



ROCKET CHAMBERS are inspected visually. Tensile, tear and dropball impact tests are also used.

Withstands 305,000 psi Pressure

Testing included determination of parent metal yield and ultimate strength. Young's modulus and per cent of elongation, ultimate strength reduction because of spot welding and a strength-to-weight comparison. This is done by dividing the ultimate strength by the material density.

TESTING RESULTS

The tensile tests alone were not enough evidence for elimination of any one of the metals. Tear tests were made because there is a correlation between the type of tear, the tearing force and the ability to predict ultimate load on laminated structures. Ryan likes to see a straight line tear—rather than a jagged line—and a high tearing force. These are desirable qualities. However, these tests were inconclusive. All alloys tested tore in a straight line. And, all required about the same amount of tear force.

Ryan then made drop-ball impact tests to measure the relative brittleness of the metals and get an idea of their relative ductility. Each alloy was tested to the fracture point. The AM355 alloy (sub zero cold rolled and tempered—30 percent cold reduced) absorbed the greatest amount of energy before failing.

One further test was made on all of the metals under consideration. The Mechanics Division of the Navy Research Laboratory helped determine brittle fracture characteristics of each.

When test results were obtained, Ryan selected four metals: HS-25, AM355 (sub-zero cooled cold rolled and tempered—both 30- and 10-percent cold reduced) and AM355 (cold rolled and tempered). HS-25 was eliminated because of its density. AM355 (sub-zero cooled cold rolled and tempered—30 percent cold reduced) was eliminated because of its relatively low tensile strength.

Ryan is now trying to raise the 300,000 psi ultimate allowable tensile stresses of laminated structures made of the AM355 series of alloys. The work centers around the modification of resistance welding techniques, including electrode shape and material, current density and wave shape, and weld nugget size. • •

turn to page 69 to see how

the aircraft industry redesigned

a stainless turbine rotor assembly

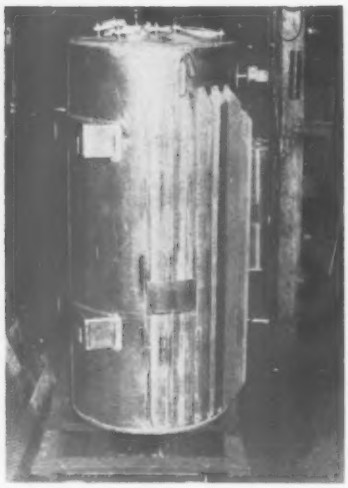
for furnace brazing,

which is 80 percent cheaper

than machining a solid forging

WELDED DESIGN
in electrical transformers

the new way . . .



TUNGSTEN ARC WELDING is used to attach fitting to aluminum transformer case (left). Completed tank with fittings and cooling fins in place is shown (right).

the results . . .

	BEFORE	AFTER
Basic Material	Mild Steel	Aluminum
Net weight of case	150 lb.	55 lb.
Weight of welding rod	7 lb.	1.5 lb.
Cost of rod, per tank	$13.65	$2.13
Labor	9 hr.—$36.00	4 hr.—$16.00
Cleaning & painting	$15.00	none
Bolts & gaskets	10.00	none
TOTAL COST, exclusive of basic material	$74.65	$18.13
SAVING		$56.52

Redesigned Transformer Case Calls For Welded Aluminum Instead Of Steel

by **C. BASTION**, *Regional Manager, All-State Welding Alloys Co., Inc.*

IN BRIEF: Welded aluminum transformer cases are light in weight, non-corrosive, non-leaking, cooler in operation and require minimum maintenance.

REDESIGNING a ferrous metal part for aluminum fabrication is not a new story. But it is always an interesting one. Here's an example:

STEEL-TO-ALUMINUM

In the West Coast's coastal atmosphere, steel transformer cases rust out in three to five years. Resulting oil leaks cause the transformer to heat up and burn out.

Howard Miller of Economy Transformer Company, Centralia, Washington, figured he could increase the life of transformer cases by making them of non-corrosive aluminum. This would eliminate oil leaks.

Of course, aluminum would cost more per pound. But there would be compensating advantages: lighter weight and easier installation, better heat dissipation, no need for painting finished cases and minimum maintenance expense.

DESIGN

Mr. Miller's Engineering Development Department designed the non-corrosive transformer cases. They rolled the tank cylinder from ⅛-inch corrosion- resistant #5356 sheet aluminum. They cast tops and bottoms from #4043 alloys.

FABRICATING PROBLEMS

Trouble came in welding the sheet to the thicker castings. Welds turned out to be porous. They cracked easily. And welding took too much time.

continued on page 80

"Baltospot is lightweight—the only completely portable 140-kv unit on the market. Ideal for inaccessible places."

E. E. Ellis says, "There's nothing to it. This unit will radiograph steel up to 1¾ inches thick."

"In less than a day I could teach anyone to make good inspection X-rays with BALTOSPOT,"

E. E. Ellis

J. B. Fisher

says E. E. Ellis, Welding Engineer and Radiographer, Fisher Tank Company, Chester, Pennsylvania. "One year of experience with Baltospot X-ray equipment proved to us that practically anyone can make good radiographs. There are just three simple steps:

1. measure thickness of part and refer to chart
2. make exposure
3. develop film according to chart

X-ray inspection keeps us on our toes and is far ahead of other methods."

Does Baltospot Pay?

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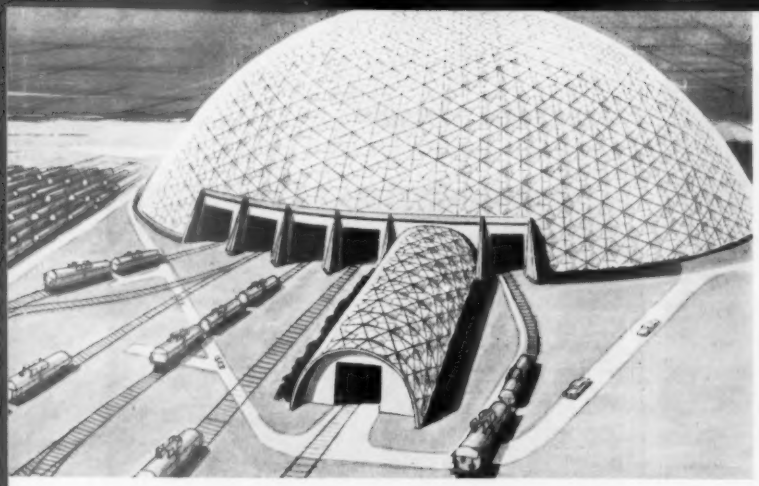
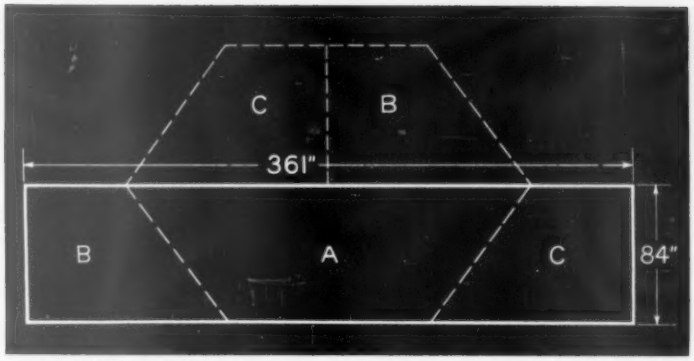
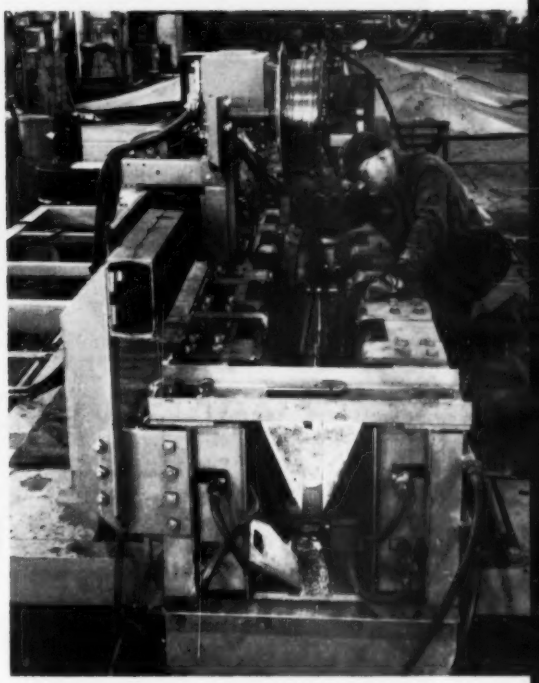


WELDED DESIGN
in buildings and bridges



PREFABRICATED PANELS are made of three pieces of sheet steel cut from sheet sizes to reduce waste. For example, the center (A) of a 361-inch long sheet makes one-half of a hexagonal panel. The other half is made by automatically welding together the square ends of the sheet (B and C). The two halves are then trimmed to design shapes and formed for welding into a hexagonal pyramid panel.



Simplified Design Cuts Cost of Second All-Welded Geodesic Dome Building

IN BRIEF: All-welded steel structure is 380-feet in diameter, is 120-feet high, has no hindering internal supports and covers a floor area of 110,000 square feet.

COST AND ERECTION TIME for a huge geodesic dome at Wood River, Illinois, have been substantially reduced. How? By simpler design, by the availability of 84-inch wide, 11-gage sheet steel, by the use of improved welding procedures and by radical changes in construction techniques.

The new all-weld steel structure is the second geodesic dome built by Union Tank Car Co., Chicago, for repairing and maintaining its railroad tank cars. Like the first at Baton Rouge, La., the Wood River dome will enclose an unobstructed free-span plant area of 110,000 square feet.

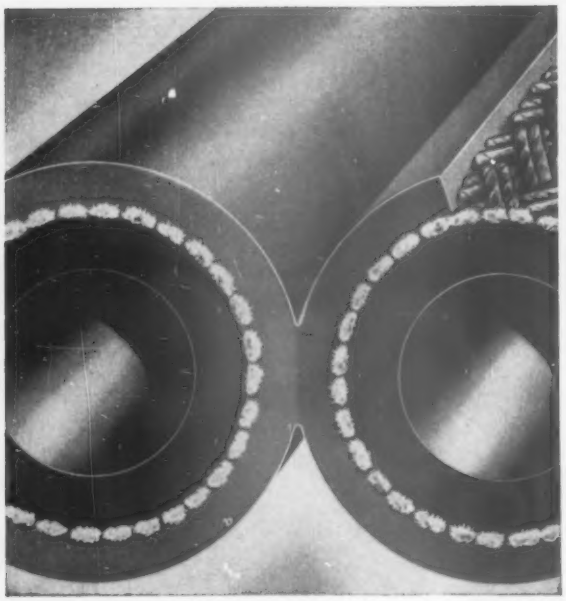
Reported cost of the Baton Rouge dome was less than $1,000,000. Although no estimates of the additional savings at Wood River are yet available, it is agreed that the cost would be "substantially" lower.

Cost-saving methods being used on the Wood River dome were engineered by Graver Tank & Mfg. Co., East Chicago, Indiana. Graver was acquired by Union Tank Car in September, 1957, while the Baton Rouge Dome was being erected.

Now, only about three-quarters as much overall welding is required. This is because Graver was able to get 84-inch wide, 11-gage hot-rolled sheet steel from Jones & Laughlin Steel Corp. This sheet steel provided a surface area of 175,000 square feet. Sheets only 48½-inches wide had been used in field-fabricating subassemblies for the Baton Rouge dome.

Prefabricated panels for the Wood River dome are umbrella-like hexagonal pyramids two-feet high and 12- to 17-feet across the base. When they are welded

continued on page 64



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STRUCTURAL WELDING

continued from page 63

TESTS MADE on a 50- by 60-foot full scale dome showed the effects of sandbag loads up to 85,000 lbs., variously distributed. SR-4 resistance wire strain gages were used on the plates, gussets and 6-inch pipe struts.

together, they form a spherical segment 116-feet high and 375-feet in diameter. Graver prefabricated about 900 of these pyramids in its East Chicago plant for assembly by its crews in the field. Larger subassemblies for the Baton Rouge dome—a central hexagonal pyramid surrounded by portions of adjoining pyramids—were completed in the field.

Sheets were supplied in 14 different lengths. This permitted making complete pyramidal subassembly panels of different shapes and sizes from each sheet with minimum waste. For example, one-half of a pyramidal panel was sheared from the center of a 361-inch long sheet. The cuts were made with the required angles for three sides of the base of the pyramid. The other identical half of the panel was made by joining the square ends of the sheared panel on an automatic welder. In this way most prefabricated panels were made of three pieces of 11-gage steel. Six pieces of 48½-inch sheet steel were required for the hexagonal pyramids in the Baton Rouge dome. The two halves were joined by manual welding after further shearing to size and bending to shape. Scrap loss was less than three percent.

The change in construction methods at Wood River was a complete reversal in the order of erection. Graver started erecting the dome at the top center on a special scaffold 30-feet high at the center. After an initial 200-foot diameter center section was completed on the scaffold, welding operators worked at or near the ground level to complete the structure.

The strut-reinforced dome was lifted step-by-step to its maximum center height by jacks and a huge air-inflated expanding pneumatic bag. After each upward step a ring of hexagonal panels was welded on the perimeter of the dome until it was completed to 375-feet in diameter.

Although the use of smaller panels at Wood River increased the amount of welding during erection, welding was easier and faster. The most significant saving in welding at Wood River was during prefabrication of panels.

A system of adjustable guy lines was used to keep the dome from slipping. These were attached to 120 points around the dome and anchored to 10 buried concrete deadmen space 36° apart on a 306-foot radius.

One difference between the completed 375-foot diameter steel domes is apparent to any observer. The external supporting truss structure is triangular at Wood River and hexagonal at Baton Rouge. The strut system at Baton Rouge is more complex. It consists of 4-inch pipe struts forming hexagons that outline each pyramid and support the dome by means of smaller steel bars connected to the vertex of each pyramid and to the corners of the base of each pyramidal panel. In effect this dome hangs by the small steel bars from the 4-inch pipe strut structure.

Graver greatly simplified the truss structure by eliminating the steel bars and using 6-inch, schedule 10 steel pipe, 12- to 17-feet long, to interconnect the vertices of all adjoining pyramidal panels. Full-scale tests under sand bag loading proved the strength of this system.

E. A. Locke, Jr., president of Union Tank Car Company, described geodesic domes as having an "incredible quality of spreading stress and strain. They require only a simple foundation and need no side bracing except for wind loads." The Wood River dome was designed to withstand hurricane winds exceeding 100 mph and snow loads up to 30 lb. per square foot. • •

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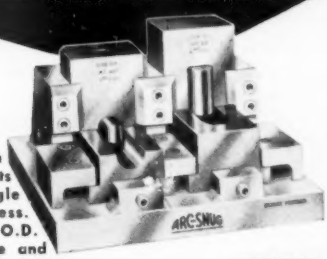

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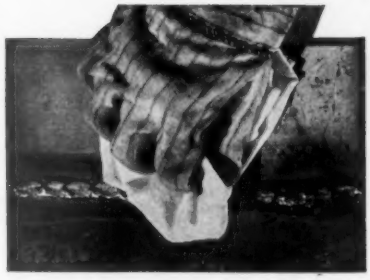

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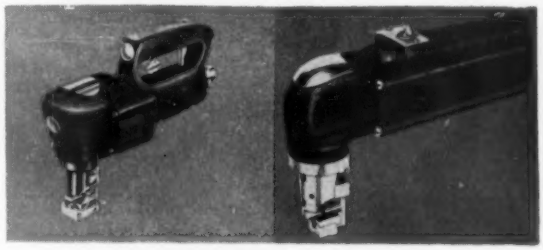

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3 Ways To Sell Structural Welding To Designers And Engineers

by **J. R. WARN**, *engineer, Havens Structural Steel Co., Kansas City, Mo.*

IN BRIEF: The three ways to sell engineers and designers on structural welding is to explain the economy of welding, the fabricator's capacity for welding and how quality of welding is controlled.

WELDING IS AN INTEGRAL PART of our everyday lives. Yet it is not accepted by many engineers.

Automobiles and rockets would be crude and atomic generators would probably be impossible without welding. However, one does not have to look far to find an all-riveted bridge being built. Schools, churches and industrial buildings are still being built with all-riveted trusses. The increased cost due to this type of construction in this country is many millions of dollars.

The blame for this extravagance lies not on the designers. It lies with the welding industry. Engineers will accept welding, almost without exception, if they get the complete story. Any engineer who has not yet accepted welding has one or more of the following reasons:

1. He does not realize the savings made possible by welding.
2. He does not understand the fabricators capacity of welding.
3. He does not trust the quality of welds.

Consider these facts. They should be presented to a disbeliever to sell him on welding.

ECONOMY OF WELDING

This is the easiest case to prepare. Trade and technical journals are full of comparative cost data. One example is the Buffalo Bayou Bridge. Figures show a saving of nearly 10 percent on the overall cost of the superstructure because welding was used.

Truss design itself demonstrates the economy of welding. Here each member section must be increased 9 to 28 percent over its entire length because of a few holes in bolted or riveted connections. When the design is for welded connections, the entire area of the member is utilized.

CAPACITY FOR WELDING

The local section of the Corps of Engineers has designed riveted girders for many years. Recently they provided in the specifications that "at the option of the contractor, the girders may be fabricated by welding in lieu of riveting. However if welding is used, the contractor shall furnish design computations covering all affected members."

I took advantage of this specification and redesigned two large girder jobs for welded construction. The first one was a 144-foot simple span and field welding was not accepted. A savings of about 12 percent in the steel was possible here. The second bridge had a 110-foot clear span. By eliminating the field splice, a saving of about 19% was effected. In both cases ours was the only company to submit a welded design and bid.

In discussions with the Corps' engineers I learned that welded design had not been previously used because it was thought that all shops were equipped to rivet but only few to weld. This was disproven at the following letting of a girder bridge. A majority of the fabricators turned in a welded design and bid.

The Corps now tell me that future girder plans will be of welded design.

Actually, only the older shops are really equipped to rivet. And, these shops have complete welding departments. The newer shops have, in many cases, only the barest minimum or no riveting equipment. Many shops also find it increasingly difficult to find competent riveting crews.

QUALITY CONTROL

This is undoubtedly the highest hurdle to clear when selling welded design. Many engineers came in contact with welding in the days of bare electrodes and the experimental era of the coated electrode. Failures did occur. The designer reverted to the old trusted connection. And he has not bothered to investigate welding as we know it today.

Engineers attending a recent welded bridge seminar in Cleveland agreed that a properly made weld would do the job intended. But, they felt they could not rely on the weld being made properly.

I know of a large automobile assembly plant that refuses to accept welded construction in its building. Yet, it makes full use of welding in its automobile assembly. It should also be noted that when added fixtures make it necessary to reinforce existing riveted trusses, welding must be used and has worked very satisfactorily.

These examples are not apathy on the part of the engineer, but on the part of the welding industry from the top producer of welding equipment to the individual member of the American Welding Society. We

continued on page 68

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O.T.R. Rubber-Jacketed Cables
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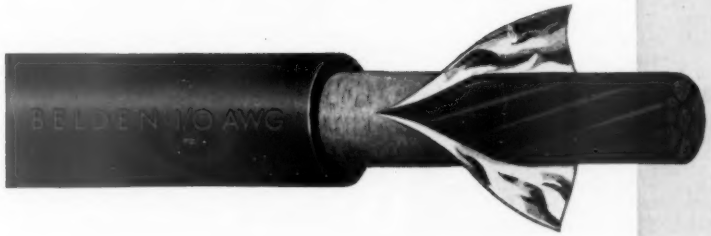

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STRUCTURAL WELDING

continued from page 66

have been too busy developing new methods and learning how to join the new alloys to worry about the fellow that is still struggling with our bread and butter material—mild steel.

This is a job everyone interested in welding and economy of building should be working on. The supplier should see that the engineer receives literature that will show him what is happening in the industry. The fabricator should see that every weld he makes is one he can be proud of. He should give the engineer an open invitation to visit his plant at any time. He could show him the amount of welding being done, and have him run a few rods to see the ease of the operation.

The salesman should have photographs of any welded installations made or erected in his community. These should be mailed or taken directly to the engineers of his area.

With a little imagination a running campaign such as this will soon convert even the most die-hard designer.

The designer of today is not a stubborn, unyielding old fogey; nor is he a man to accept anything on fast talk alone. He must see examples, data and research results.

The welding industry must assume the responsibility of bringing these men up-to-date and keeping them up-to-date.••

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All-State Welding Alloys Co., Inc., White Plains, N. Y.: *Kirk's Auto Electric, Inc.,* Bowling Green, Ky.; *Seaboard Oxygen Service,* Plymouth, N. C.; *Welders Supply Co.,* Beloit. Wisconsin.

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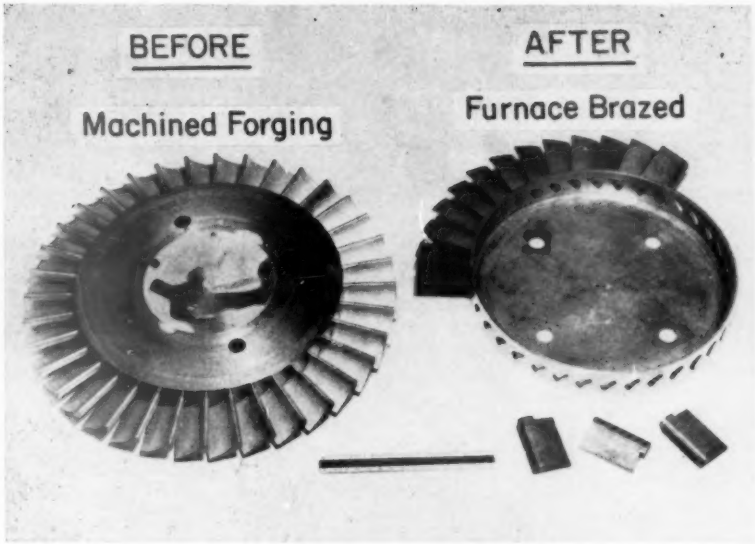
United Specialties, Inc., El Dorado, Arkansas: *Nick H. Dosker, Jr.,* Louisville, Ky.; *E. R. Laden,* Fort Wayne, Indiana; *George T. Oberklein and Associates,* Cincinnati.

WELDED DESIGN *in turbines*



Redesign For Furnace Brazing Cuts Costs 80 Percent

IN BRIEF: Stainless turbine rotor assembly used to be machined from a solid forging; now it's a furnace brazed assembly.

REDESIGNING A STAINLESS turbine rotor assembly for furnace brazing cut a startling 80 percent from processing costs, including labor and materials.

OLD WAY

The part was originally machined from a Type 347 stainless steel forging. This was costly. Extensive and careful machining was needed to produce precisely contoured blade segments. However, machining from the solid was considered the only way to meet the critical dimensional requirements of the rotor.

REDESIGN

Wall Colmonoy Corporation's Stainless Processing Division redesigned the rotor for furnace brazing, using Type 347 stainless details. The rotor hub is produced by brazing together a pre-machined stainless ring and disc. The ring has airfoil-shaped slot in which blade root forgings are inserted. The forged blades are finish machined before brazing.

RESULTS

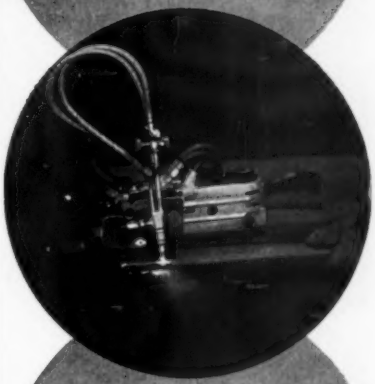
Separate production of the blade segments slashed scrap costs. Improper machining of a blade in the brazed design, for example, means scrapping only the blade forging. On the other hand, improper blade machining in the machined-from-the-solid design meant scrapping the entire rotor forging.

TECHNIQUES

The 38 separate pieces used are brazed at the same time using Nicrobraz alloy in a pure dry hydrogen furnace at 2150°F. Close control of the brazing cycle prevents distortion. It also keeps critical dimensions within tolerance limits set up for the turbine rotor application.

The design eliminates any need for elaborate brazing fixtures to hold details together during brazing. A simple machined ring-type fixture supports the blades in the furnace.

IMAGINE!



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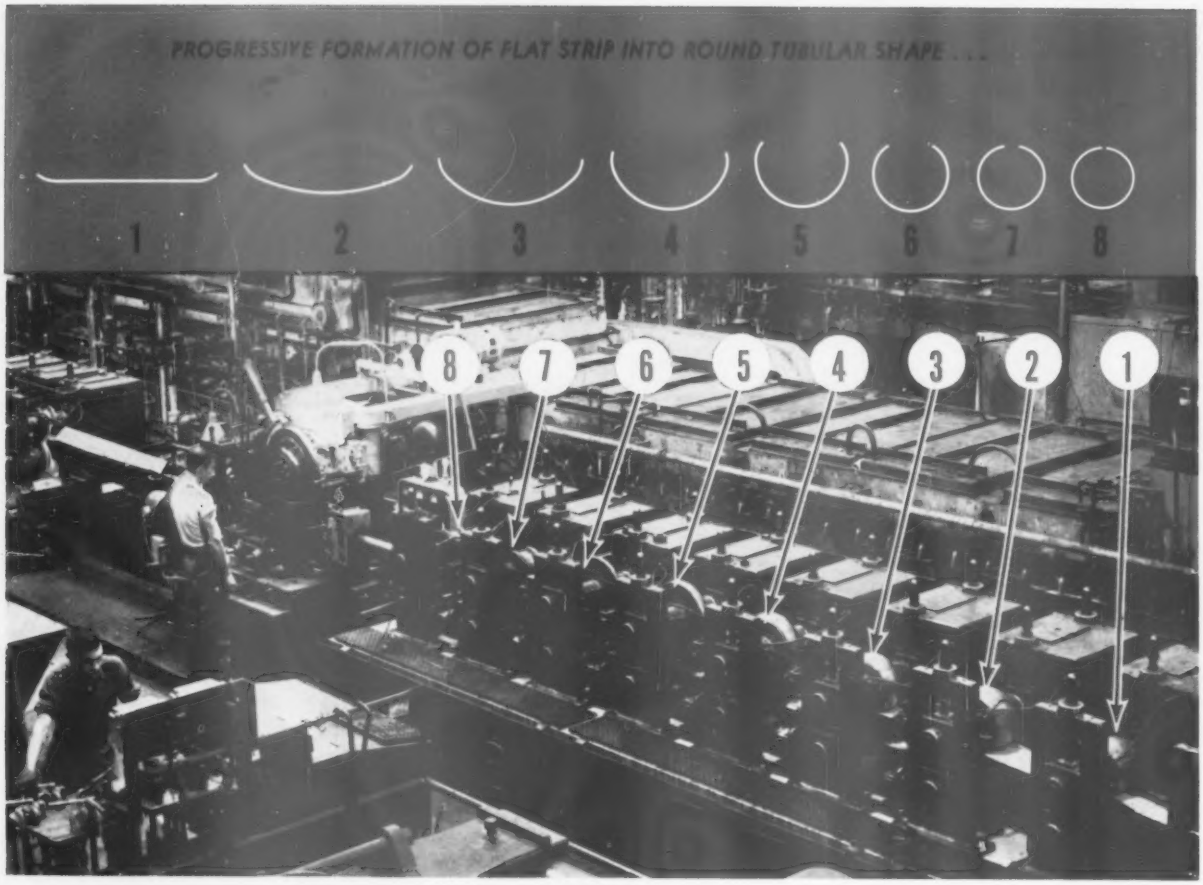


Quality Control System Governs Each Step In Production of Welded Steel Tubing

IN BRIEF: Developed to meet the needs of the petrochemical industry, new electric resistance welded carbon steel tubing is uniform, easy to work, strong and less costly than seamless tubing.

THERE'S ONE BEST WAY to resistance weld heat exchanger tubing. Ask the people who know, the Babcock & Wilcox Co., in Alliance, Ohio.

Their new welded tubing bears the trade name "Lectrosonic." They've tested it extensively in actual use for five years. It has proved equal to or superior to seamless carbon steel heat exchanger tubing.

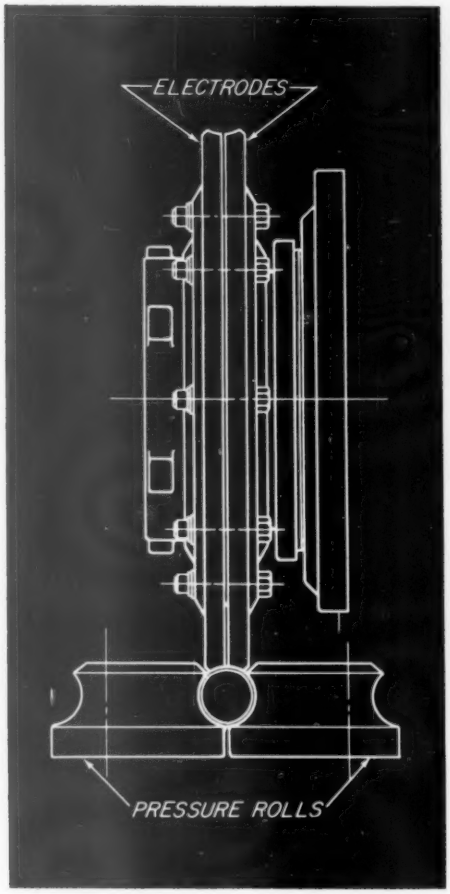
Lectrosonic tubing is the result of a five-year program of metallurgical research, the development of better quality control, better tests, and fabrication technique studies.

BACKGROUND FOR DESIGNERS

Electric resistance welded carbon steel pressure tubes are presently in use in heat exchangers and condensers for the refining, petrochemical, chemical and refrigeration industries.

Welded pressure tubing is also used in marine and stationary boilers. This tubing operates in service in boilers at pressures as high as 2700 psi. Specifically, tubing is used in boiler, water wall, supply, riser superheater, economizer, reheater and attemperator applications within the limits of manufacturing and temperatures to which carbon steel seamless tubes may be subjected.

Electric resistance welded pressure tubing was first approved by the ASME Boiler Code Committee in the middle 1930's. In 1942, B&W began the manufacture of this tubing to augment the supply of seamless tubes for boiler and other pressure applications



APPLICATION OF PRESSURE by rolls on both sides and beneath the electrodes (left) force the heated tubes edges together to form a weld.

FLASH WELDING (below) butt welds coil ends to make a continuous strip.

requirements. During World War II, a large percentage of tubing for marine boilers was of this type.

The shortage of heat exchangers and condenser tubes became more acute after America entered the war. In this emergency, manufacturing specifications and codes were relaxed. The resulting product was unsatisfactory and the manufacturers received an unjustifiable loss of prestige.

This prejudice has been gradually disappearing. An increasingly large percentage of welded steel tubing is being used today to replace seamless tubes.

Here's what takes place from start to finish at the B & W tube plant.

INTEGRATED QUALITY CONTROL

Control of Lectrosonic tube weld quality begins long before the actual welding. It begins with the steel. It comes as coiled strip steel. A strip inspector from the metallurgical department cuts samples from each heat, size, and shipment. He records the hardness, thickness, width, and the test results.

The strip inspector sends the samples to the laboratory. The lab mills sections from the full cross section for chemical analysis. This is to make certain that the steel meets B & W's specifications.

The lab then macroetches and examines the sections for pattern structure and for defects such as undue segregation, pipe or pockets in the metal, seams, and slivers. Coils showing defects are rejected.

They examine the coils visually for surface defects, shape, thickness, and width, and to check the ends for evidence of pipe. They reject coils with visible defects, dimensional inaccuracies, or anything else that would result in defective tubes.

FLASH BUTT WELDING

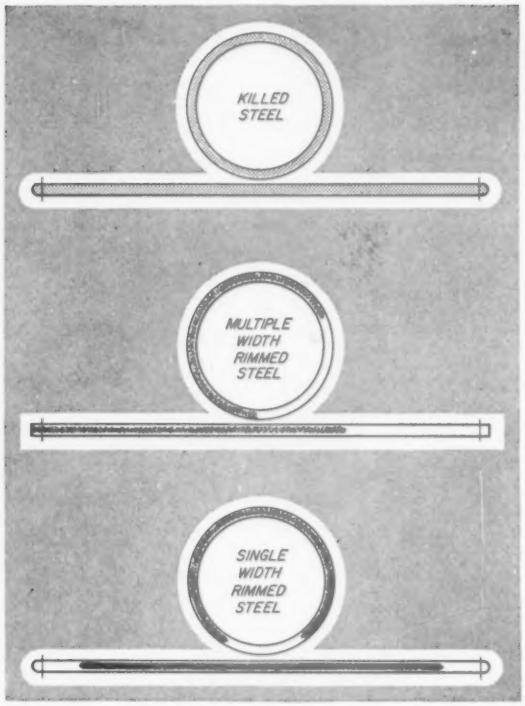
They feel the coil to a leveler for flattening, then cut ends of the strip square and butt weld the ends of the preceding and following coils. That makes an endless strip, which is run into a floor or overhead loop. To make it easier to identify the butt weld area, which is not used in the final product, they punch holes about 2 feet from each butt weld.

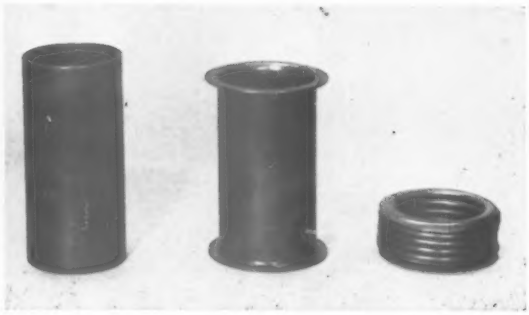
ROTARY SLITTER

Feeding from this loop, the strip enters the rotary slitter in line with the welding mill, where it is edge-

continued on page 72

WELDED TUBING *continued from page 71*





B&W CONTROLS weld quality in three ways:

ABOVE: Multiple width rimmed steel is never used for making pressure tubing. Why? The core metal upsets to the inside and outside of the tube at the weld as shown. The result is that bands of inclusions act as planes of weakness on deformation tests.
RIGHT, TOP: Nondestructive testing is done with ultrasonic equipment which monitors the weld as it is being made. Suspect welds are checked further by fluorescent magnetic particle inspection equipment.
ABOVE: Destructive tests include crush test (shown), flattening, reverse bending and flanging tests.

slit to an exact and constant width. A fresh edge, free of rust or mechanical damage, is thus produced seconds before welding.

IDENTIFICATION

As the flat strip enters the welding mill, code symbols for each heat and size are rolled into the strip every 40 inches. "B&W" and a symbol for the type of tubing and the operator of the welding mill are included.

CONTOUR SHAPING

The strip enters the forming mill. A series of rolls, gradually turn the strip into cylinder, as the photo shows. The two edges of the strip are forced together under the welding electrodes, which ride on the upper surface of the formed tubing on both sides of the seam. The picture shows this clearly.

The forming rolls must be accurate to turn out reproducible results. A modern roll shop makes and maintains these rolls. Their contours are examined after ever long run, the rolls are reshaped whenever necessary.

ELECTRIC RESISTANCE WELDING

In the resistance welder, electrodes come in contact with the upper surfaces of the formed tube on either side of the seam, while pressure rolls located below the electrodes provide the pressure required to bring the edges of the tubing into contact. The electrical resistance to the flow of current across the joint cause intense localized heat. Under pressures of electrodes and front and back squeeze rolls, the strip edges are welded together.

FLASH REMOVAL

The outside and inside flashes (or heads) formed in welding are continuously removed by special cutting tools as the tubing comes out of the welding mill.

INLINE ULTRASONIC INSPECTION

The weld quality is checked continuously on an ultrasonic flaw detector immediately after the cooling trough and ahead of the sizing mill. An inspector at

continued on page 78

GMC Uses Statistical Methods To Improve Projection Weld Quality

IN BRIEF: Plotting tensile tests on average and range charts gives a more positive check on projection welding quality than hammer-blow impact tests and visual inspection.

PROJECTION WELDS are sometimes checked by an impact test, such as a hammer blow.

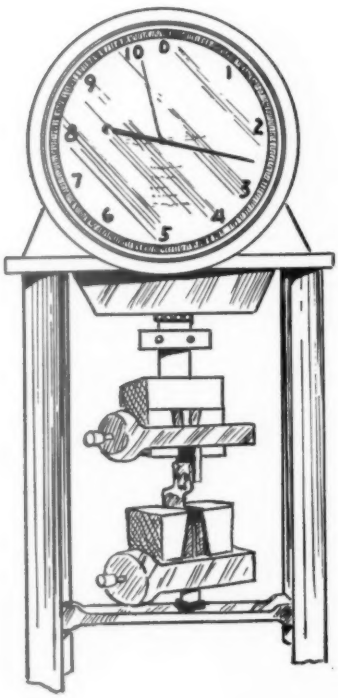
Properly calibrated, an impact test detects defective welds. But, over an extended period of time many borderline welds may be accepted as satisfactory.

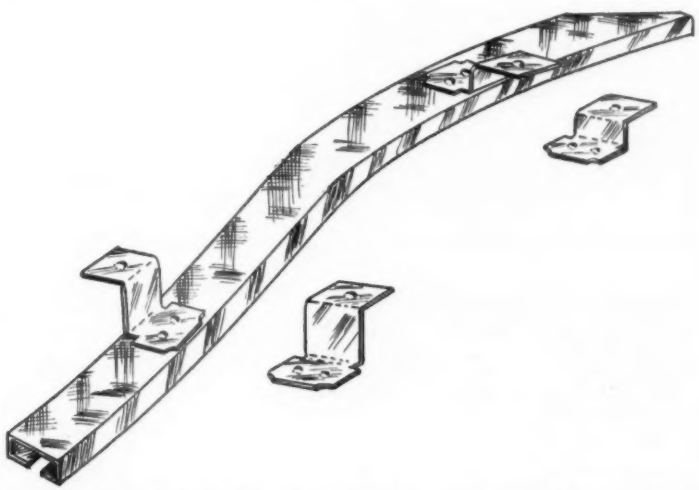
Another way to check projection weld quality is the visual inspection of weld appearance. Inspectors can examine symmetry of weld spots, degree of heat discoloration, space between welded surfaces, or excessive "dimpling" of unmelted projections. However, such visual inspection is subject to individual interpretations because there are few established standards. Furthermore, there is limited knowledge of the relationship between the visual inspection factors involved and true weld quality.

A typical example of projection welding is the high volume fabrication of automobile hardware. Many of these are used in concealed positions in highly inaccessible doors and body panels. The cost of replacing defective parts in the final assembly plant or in the field is far greater than the original production cost. Therefore, maintaining high levels of weld quality becomes very important.

Engineers at the GM Division, which manufactures

EDITOR'S NOTE: *This article is reprinted from the "General Motors Engineering Journal" © 1959 by General Motors Corp. This is a representative problem based on data taken from a General Motors Institute Fifth Year Project Study Report.*





TYPICAL OF AUTOMOBILE hardware assemblies made by projection welding is the guide assembly for a window regulator. The brackets are projection welded to the channel. To evaluate weld strength, a destructive test is performed on test specimens by a tensile testing machine similar to the one at left.

turn the page to see what GMC learned by making tensile tests on projection welded parts

TESTING PROJECTION WELDS

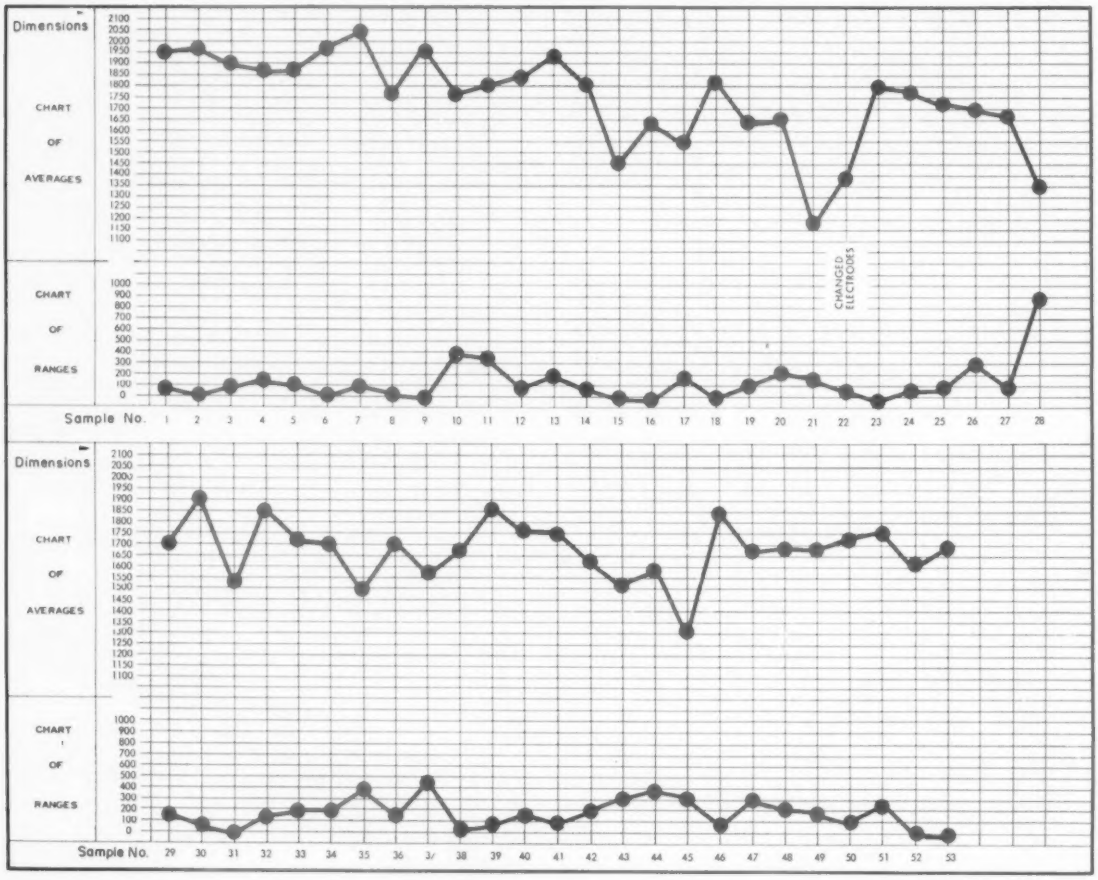
continued from page 73

these hardware assemblies, tried to establish a program for checking welding quality. The approach? Obtain weld data free from individual interpretations. Then use the data to apply statistical quality control.

Initial analysis indicated the need for a test to provide measurable evaluation of weld tensile strength.

A non-destructive type of test was first thought desirable. The ultrasonic method was considered. Investigation showed that this method would not be suitable for small projection welds of the type under study.

Tensile tests plotted on range and average charts looked like this . . .



DATA OBTAINED from the weld strength test was recorded on average and range charts. A total of 53 samples was used for the test. Each consisted on two specimens. Columns X_1 and X_2 of the table list tensile strength readings taken from the tensile testing machine to the nearest 25 pounds.

Sample No.	Each Item in Sample	
	X_1	X_2
1	1925	2000
2	1950	2000
3	1850	1950
4	1800	1950
5	1850	1900
6	2000	2000
7	2100	2000
8	1750	1800
9	1975	1975
10	1550	1950
11	2000	1600
12	1900	1800
13	1850	2100
14	1750	1850
15	1500	1450
16	1675	1650
17	1650	1475
18	1850	1825

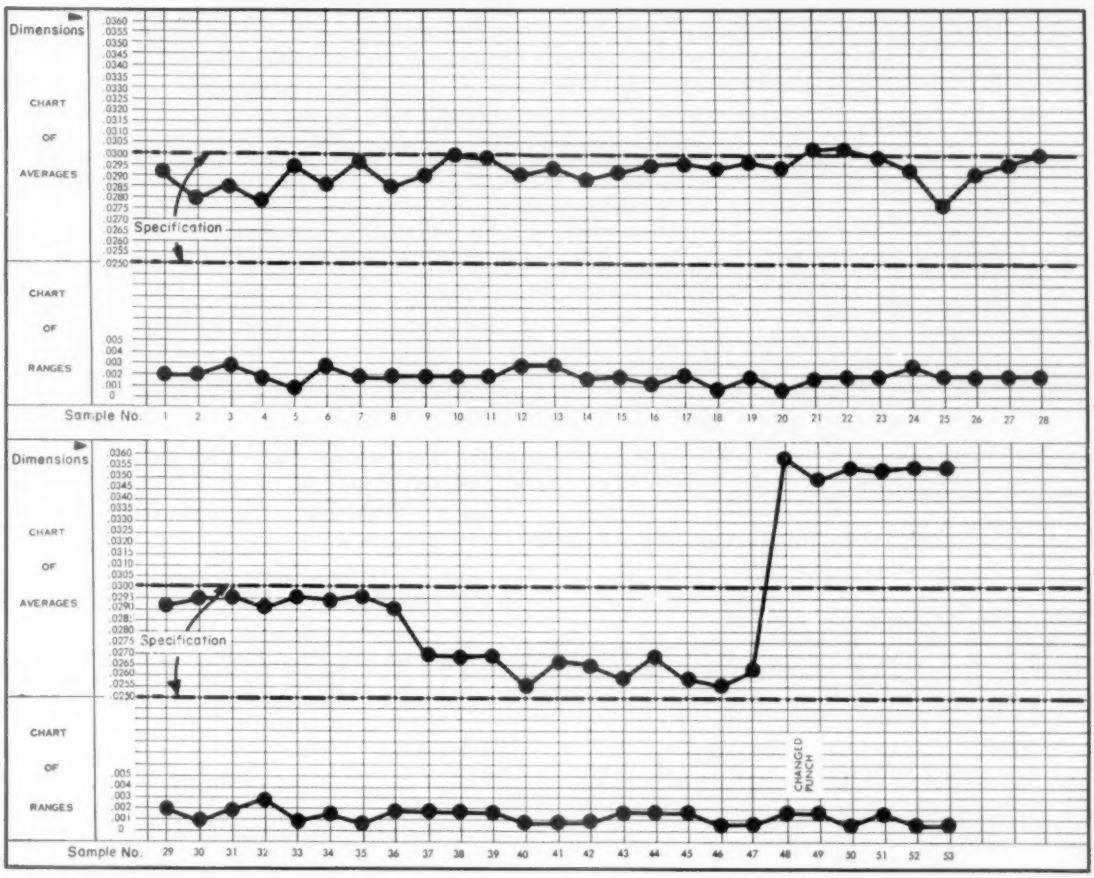
Sample No.	Each Item in Sample	
	X_1	X_2
19	1700	1525
20	1725	1500
21	1300	1100
22*	1350	1450
23	1750	1800
24	1700	1800
25	1625	1775
26	1500	1875
27	1575	1725
28	1850	900
29	1750	1600
30	1900	1950
31	1525	1525
32	1800	1900
33	1800	1650
34	1600	1800
35	1300	1700
36	1775	1625

Sample No.	Each Item in Sample	
	X_1	X_2
37	1350	1800
38	1650	1700
39	1900	1825
40	1850	1700
41	1700	1825
42	1525	1750
43	1700	1350
44	1800	1400
45	1475	1150
46	1900	1800
47	1500	1850
48	1600	1825
49	1600	1825
50	1800	1675
51	1625	1900
52	1625	1650
53	1700	1725

It was finally decided to use flat test specimen and a tensile testing machine. Such a test would permit a decision on the desirability of a special test fixture for testing welded production parts. A destructive test was performed on two specimens approximately once each hour over a six day period. The data obtained was recorded on average and range charts.

It was realized that weld strength was not only dependent on welding factors (machine-control settings and electrode condition) but also depended on projection height and zinc-plate thickness. Therefore, it was decided to check both the projection height and zinc-plate thickness against production specifications.

These tests showed projection weld height cannot be overlooked . . .

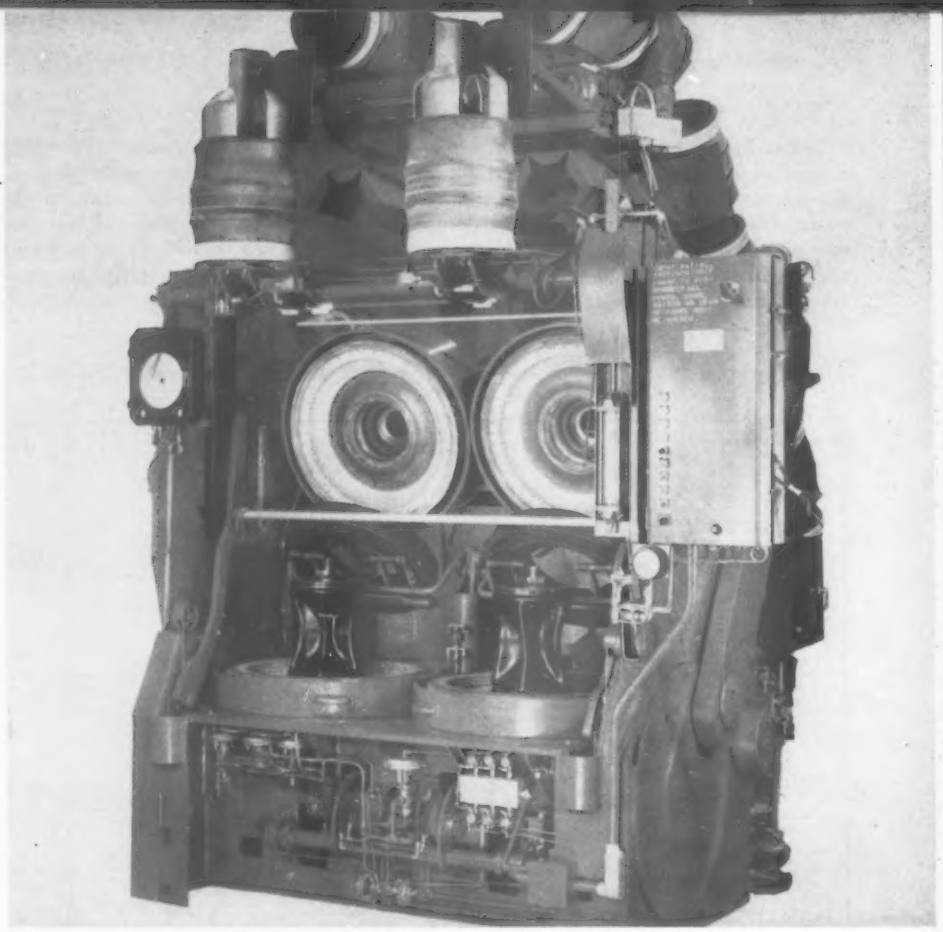


Sample No.	Each Item in Sample			
	X_1	X_2	X_3	X_4
1	.028	.030	.029	.030
2	.027	.029	.027	.029
3	.028	.029	.027	.030
4	.028	.028	.029	.027
5	.029	.030	.029	.030
6	.029	.030	.029	.027
7	.029	.031	.029	.030
8	.028	.029	.028	.030
9	.029	.030	.028	.030
10	.030	.031	.029	.030
11	.030	.029	.030	.031
12	.029	.031	.028	.029
13	.028	.030	.029	.031
14	.028	.030	.028	.030
15	.028	.030	.029	.030
16	.029	.030	.029	.030
17	.029	.031	.029	.030
18	.029	.030	.029	.030
19	.030	.031	.029	.030
20	.029	.030	.029	.030
21	.029	.031	.030	.031
22	.031	.031	.029	.030
23	.030	.031	.029	.030
24	.028	.029	.031	.030
25	.027	.029	.028	.027
26	.030	.028	.029	.029
27	.030	.029	.031	.029
28	.030	.029	.030	.031
29	.030	.028	.030	.029
30	.030	.029	.030	.029
31	.030	.029	.030	.029
32	.031	.028	.030	.028
33	.030	.029	.030	.029
34	.029	.029	.031	.029
35	.030	.029	.030	.030
36	.030	.030	.029	.028
37	.026	.027	.027	.028
38	.027	.027	.026	.028
39	.027	.026	.027	.028
40	.026	.026	.025	.026
41	.026	.027	.027	.027
42	.026	.027	.026	.027
43	.026	.027	.025	.026
44	.026	.027	.027	.028
45	.025	.026	.026	.027
46	.025	.026	.026	.026
47	.026	.027	.026	.027
48*	.035	.037	.035	.036
49	.034	.036	.035	.035
50	.035	.036	.035	.036
51	.036	.035	.034	.036
52	.035	.036	.035	.036
53	.035	.036	.035	.036

*Changed punch.

PROJECTION HEIGHT was one factor that affected weld strength. Measurements were made on 53 samples. Each consisted of four specimens. Data collected was plotted as shown. The production specifications called for projection heights of 0.025 to 0.030-inches. The table at left lists projection height measurements (in inches) for each sample.

The latest thing in tire curing is automation; it's possible because this machine's . . .



KEY TO STRENGTH of the fully automatic tire press is its rigid base assembly.

Welded Base Is Designed To Absorb

IN BRIEF: Shaping and curing a tire takes terrific pressures. Here's how a leading manufacturer designed and built production units to do it automatically—two tires at a time.

ONE OF THE MOST important operations in tire making is curing. One of the most important names in automatic tire vulcanizing machines is the McNeil Machine and Engineering Company in Akron, Ohio.

Their engineers have recently designed and patented a completely automatic loading and unloading tire curing press. They call it the "Bag-O-Matic" (See photo of finished product.) You can see how complex it looks, but it's surprisingly simple to operate. The press automatically receives an uncured tire and shapes the tire on closing. After a twenty-minute cure the press automatically opens and ejects two finished automobile tires.

The welded steel machine with its moving arms and gadgets is designing at its best. Welded fabrication permitted a clean, simple design not possible with any other manufacturing method.

FABRICATION:

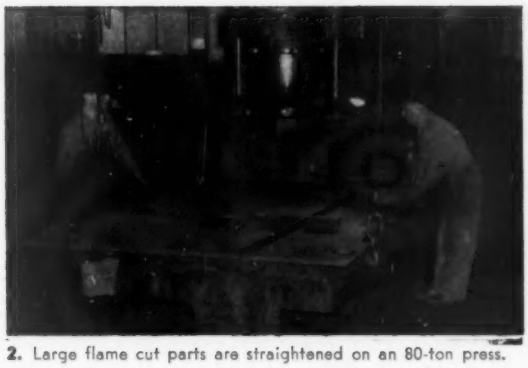
Typical of rubber processing equipment made by McNeil is their most popular, the 40-inch twin-tilt-back "Bag-O-Matic" vulcanizing press. An operator used to load the uncured tire by hand, now the 40-inch twin-tilt-back loads and unloads them automatically.

A lot of welding goes into this 40-inch press. The largest and most important weldment is the base assembly. The base must withstand pressures of one-half million pounds. The base takes about 40 hours of welding time, and that's a lot of welding.

The base assembly is made up of mild steel parts. Most of these parts are flame cut. Cutting is done with templates and multiple-head-type flame cutting machines. All large plates are first straightened in an 80-ton hydraulic press (See illustration). This pre-straightening saves McNeil set up time in the fitup and tack fixtures. The straightening press is located between the steel process bay and the welding department. This makes plate handling economical.

All flame cut and stack drilled parts that go into the base assembly are stacked neatly next to the fitup

1. Operator flame cuts steam platen with multiple tip machine.



2. Large flame cut parts are straightened on an 80-ton press.

3. Neatly stacked, press base parts are ready for fitup.

4. E 6020 electrodes are used to weld the base assembly.

A Half Million-Pound Squeeze

area (See photograph). McNeil finds this very handy and economical. Fitup men have no trouble handling the parts. They need only to move them a short way. This also saves handling time.

CHOICE OF ELECTRODES

To weld the press's base, McNeil uses electrodes which yield the least porosity for fitup, 5/32-inch and 3/16-inch E6012 electrodes are used. For welding the base they use ¼-inch E6012 and ¼- and 5/16-inch E6020. McNeil uses stringer beads on the complete base. On larger welds they use ¼-inch E6012 at 350 amps (a.c.) and complete the welds with 5/16-inch E6020 at 475 amps (a.c.).

They find the E6020 mineral type electrode (they call it a hot rod) produces high speed quality welds in downhand, horizontal, or positioned fillets

DESIGN SPECIAL POSITIONERS

Welding department supervisors cooperated with engineering department to develop many special jigs, positioners and portable elevators

With their two-station fitup area, McNeil keeps seven positioners busy on each 8-hour shift. The portable elevators also speed welding, and reduce operator fatigue.

McNeil follows strict welding sequence. All weld joints are numbered and welded in specific order. This helps to control distortion and makes stress relieving unnecessary.

Specialization among McNeil welding operators make them more efficient. Some operators specialize in fitup, others in tacking, and still others do final welding. Each man is qualified to fill in for another in an emergency.

INSPECTION

To check weld quality, McNeil uses close visual inspection. The Inspection Department is directly responsible to the Plant Manager for weld quality.

CLEANING

All weldments are cleaned by grinding, or shot

continued on page 79

WELDED BASE

continued from page 77

blasting. Abrasive blast cleaning insures good, clean surfaces for paint priming.

MACHINING

To insure perfect alignment in assembly of the Bag-O-Matic press base, McNeil does all final machining after welding. Accuracy of machining is critical. First, the top surface of the base plate is planed. The purpose is to get a perfectly flat surface on which to mount the base for milling. This is done on their 6-inch bar horizontal milling machine. Two bases are placed back-to-back on the table and are machined at the same time. This kills two birds with one stone. Only one setup is needed to efficiently mill, drill, bore, ream and tap the side, front and back of the two bases. • •

WELDED TUBING

continued from page 72

each mill checks weld quality at all times not only by ultrasonic inspection, but also by deformation tests, fluorescent magnetic particle examination. When a defect greater than the established limit shows up, an alarm circuit lights a warning lamp on the oscilloscope, activates a horn at the mill inspectors' stations and trips a spray gun which marks the tube at the defect.

On leaving the welding mill, the tubing is accurately sized and straightened in a sizing mill. Then it is cut to mill lengths. The tubes contain the strip joints, identified by holes, are discarded at this point.

NORMALIZING

All heat exchanger tubes are completely normalized in controlled-atmosphere furnaces to a uniform structure throughout, and their surfaces are given a rust-retardant oxide finish. The tubes, while still in a protective atmosphere, are cooled before they emerge from the furnaces. This prevents the formation of a heavy scale.

MECHANICAL TESTING

Emerging from the normalizing furnace, the tubes are conveyed through rotary straighteners discharging to the cutoff machines, where each tube is cut exactly to the required length. They cut coupons from the ends of the tubes and test them mechanically. Some are flattened, with the weld at the flattened edge: others are expanded and flanged: and still others are given the reverse flattening test, as shown in the illustrations.

PRESSURE TESTING

All heat exchanger tubes are hydrostatic tested at 1000 to 6000 psi as required. The test pressure depends on the diameter and thickness of the tubing and is the maximum allowed by the specification. A timer flashes colored lights to show the testers when the tube is at pressure and when it has been held there long enough. While at pressure each tube is struck with a mailet to shock it, to disclose any weak spots.

Final inspection includes surface examination, micrometer check of dimensions, and a length check. • •

HI-AMP

ELECTRODE HOLDERS

CABLE ATTACHMENTS

GROUND CLAMPS

Offers

T.P.C.*

* THREADED POWER CONNECTION

Excessive heat in a welding circuit is oftentimes caused by a resistance build-up at some point in the welding circuit due to connections being loose or oxidization setting up in a mechanical type of terminal connection.

Shown in the above "cut-a-way" picture of an Elec trode Holder is the new HI-AMP, T.P.C. type of connection that can be adapted to ground clamps and quick disconnect plugs as well as to electrode holders.

T.P.C. means a Threaded Power connection using the pressure of threads on a sleeve to drive the ends of any welding cable down into the depth of a cable socket, then locked into place with threaded plugs. An excellent electrical connection as well as providing direct contact with the welding cable to the accessory so that maximum heat is conducted into the heat-absorbing cable.

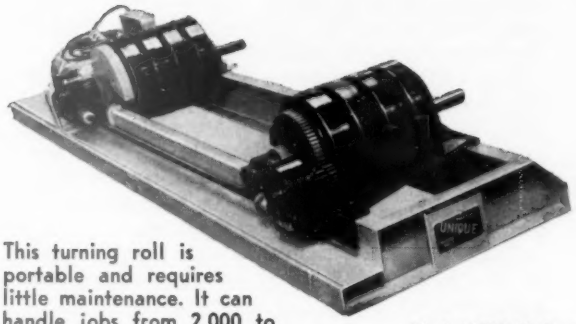
ASK YOUR WELDING SUPPLY HOUSE FOR FURTHER INFORMATION

354 W. ADAMS ST. LENCO, INC. JACKSON, MO.

For More Information Circle No. 45 on Reader Service Card.

Cut your welding costs, improve your weldments

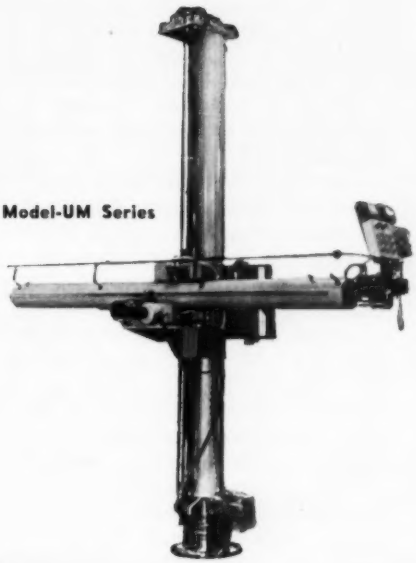
By using Unique equipment you can slash your welding costs in half, reduce handling of work, yet increase your welding production and perfection.



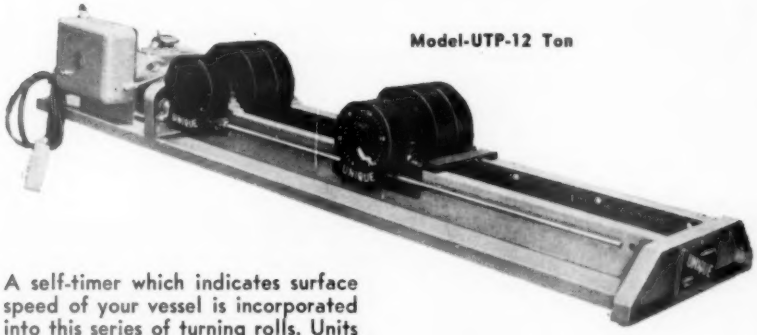
This turning roll is portable and requires little maintenance. It can handle jobs from 2,000 to 500,000 lb.

Model-UTP-60 Ton

Model-UM Series



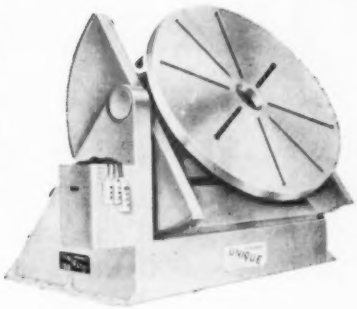
Model-UTP-12 Ton



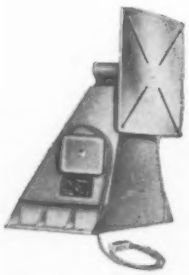
A self-timer which indicates surface speed of your vessel is incorporated into this series of turning rolls. Units are available with 3,000, 5,000, 10,000 and 20,000 lb capacities.

Here is a Unique welding head manipulator featuring variable speeds from 0 to 100 ipm. It has a double chain lift for safety, completely adjustable boom for leveling, and comes in sizes ranging from 6 by 6 ft. to 16 by 20 ft.

Welding positioners, when combined with other Unique equipment, will make your weldor a one-man production line—with push-button accuracy all the way. These precision gear-driven positioners are available in models ranging in capacity from 250 lb to 100 tons.



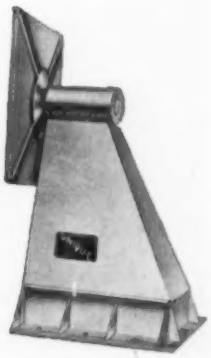
Model-UHDP-75 Ton



Unique Equipment, Inc.

Exclusive designers of positioning equipment

122 SUMPTER STREET BROOKLYN 33, NEW YORK



These head and tailstocks will provide you with variable or constant speeds, and can handle from 1,000 to 200,000 lb.

For More Information Circle No. 76 on Reader Service Card.

PRESSURE VESSEL

continued from page 55

and tell-tale holes used when a vessel will be subjected to heavy corrosion or mechanical abrasion. When the vessel has corroded to the bottom of a tell-tale hole, leakage from the hole gives a warning that the vessel has corroded to the minimum allowable thickness. For example, suppose the minimum thickness required in a particular vessel was 3/8-inch. But, to increase the service life, a 7/8-inch plate was used. The corrosion allowance would be 1/2-inch.

Tell-tale holes placed on about 18-inch center are drilled 3/8-inches deep from the surface not affected by corrosion.

The A.S.M.E. Code under Par. UG 25d states: "Tell-tale holes—when the thickness of the material has been increased as required in (a) vessels subject to corrosion, erosion or mechanical abrasion) tell-tale holes may be drilled to provide some positive indication when the thickness has been reduced to a dangerous degree. When tell-tale holes are drilled, they shall be at least 3/16-inch in diameter and shall be drilled to a depth not less than 80 percent of the thickness required for a seamless shell of like dimensions. These holes shall be drilled into the surface opposite to that where deterioration is expected."

Users of vessels where heavy corrosion takes place should provide some means to indicate when a vessel has been seriously thinned. • •

NUCLEAR-POWERED SHIP

continued from page 57

heads and a cylindrical body. The heads were formed on a hydraulic press from single plates 152-inches in diameter and 6 1/2-inches thick. Finished heads measure 8-feet 2-inches ID, 9-feet 3-inches OD and are 4-feet 7-inches high. After forming, heads were checked for surface defects by magnetic particle equipment.

Then a beveled welding groove was flame cut on the top edge of the heads. One head was welded to the body flange, the other to the body itself, by the submerged arc process. A 2-million volt X-ray unit was used to inspect welds. After final machining, the heads were tested hydrostatically to 3,000 psi, which is 50 percent above the designed working pressure.

Babcock & Wilcox Company was the prime contractor for the design and manufacture of the nuclear powerplant. • •

ALUMINUM TRANSFORMER

continued from page 60

Bob Miller, who supervised the welding procedures, called on his local welding supply distributor for help. Don Gittings of Welders Supply Co. came up with two suggestions. He recommended meticulous care in sanding and cleaning the aluminum before welding. He also recommended using tungsten inert are welding with a #5356 rod.

TISCO®

TIMANG®

MANGANESE-NICKEL STEEL

WELDING PRODUCTS

Timang Manganese Welding Rod fuses easily and does not weaken the parent metal. Weld has the same work hardenability and wear characteristics as Manganese Steel. Rods, Bars, Plates, Etc. are excellent for repairs and new installations.

WELDING RODS — PLATES — BARS — SPECIAL SHAPES

TAYLOR-WHARTON CO. DIVISION OF HARSCO CORPORATION HIGH BRIDGE 10, NEW JERSEY

PLANTS: Cincinnati, O. — Birmingham, Ala. — Easton, Pa. SALES OFFICES: New York — Chicago — San Francisco

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WELDING PROCEDURES

Economy Transformer and Welders Supply developed these successful procedures.

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The transverse seam around the casting is welded. This makes an open-top tank. Fittings and cooling fins are then welded to the side of the tank with the same alloy.

The next step is to insert the coil or winding into the tank and seal the top casting with another transverse weld. Weather heads that protect electrical connections are then welded on. Again the hand torch, which has a 1/8-inch two-percent thoriated tungsten electrode, is used. Argon shielding gas used flows at 14 liters a minute.

Alternating current is used with high frequency to stabilize the arc and cause ionization (same as neon in a cold tube). The high frequency has a cleaning action, making a clean-as-welded finished procedure. Amperage is controlled by a control. The operator can get 0 to 300 amps by pushing down on the foot-controlled rheostat. This arc control determines depth of penetration and width and height of the weld bead. • •

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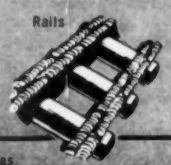

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WELDED LATHE

continued from page 53

that of a long horizontal lathe bed attached to a boxy headstock. Our problem here was to give the two weldments an integrated look. We did this by extending the lines of the chip-coolant pan face form across the front of the headstock. The continuity of the bed-ways was picked up by the forms above the gear box. We tied the supporting forms together under the pan to get rhythm and unity.

We picked up the established horizontal motif and repeated it in throughout the lathe's secondary elements: color areas, line and shape. The horizontal emphasis lends a harmonious repeat note to the many components. It also gives a down-to-earth, rugged stability to the assembly.

We did not try to modify the crisp lines resulting from flame cut, formed and welded plate. Keeping within the practical limitations and considerations, we used the necessarily square corners to provide a sheer silhouette.

To soften what would otherwise be a severe design—and to repeat and suggest the rotation of the spindle—we gave the top of the headstock a generous radius rolling over onto the front face. In reading a low low highlight on this full radius, the eye also receives the impression of a lower, more compact mass. The full radius on the front of the headstock and the turned-back surface at the top of the chip-coolant pan present smooth, non-snagging forms to the operator.

Wherever possible, we used bent plate corners instead of welded corners. This was done for two reasons: economy and appearance.

We matched lines and surfaces on the cast apron and tailstock to those of the weldments.

Standard procedures for finishing welded plate were followed. We made no attempt to conceal the fact this is essentially a welded product. However, to minimize weld roughness we carefully selected paint according to its color and reflective index. The blue-green principal color we finally selected was also chosen for the contrast it offered to unpainted, machined metal surfaces. We felt this paint would emphasize chips, coolant and dirt and call attention to areas needing cleanup.

We stratified color on controls to point up the function of various knobs and levers. We accented in red all feed controls below waist height. We used yellow on spindle controls above waist height. When at the headstock, the operator can reach principal operating controls without changing his position. These controls are within a spherical arc with a 24-inch radius.

We completed the essential design in four months. We did so because of close liaison and cooperation between our staff and Clearing's engineering department. • •

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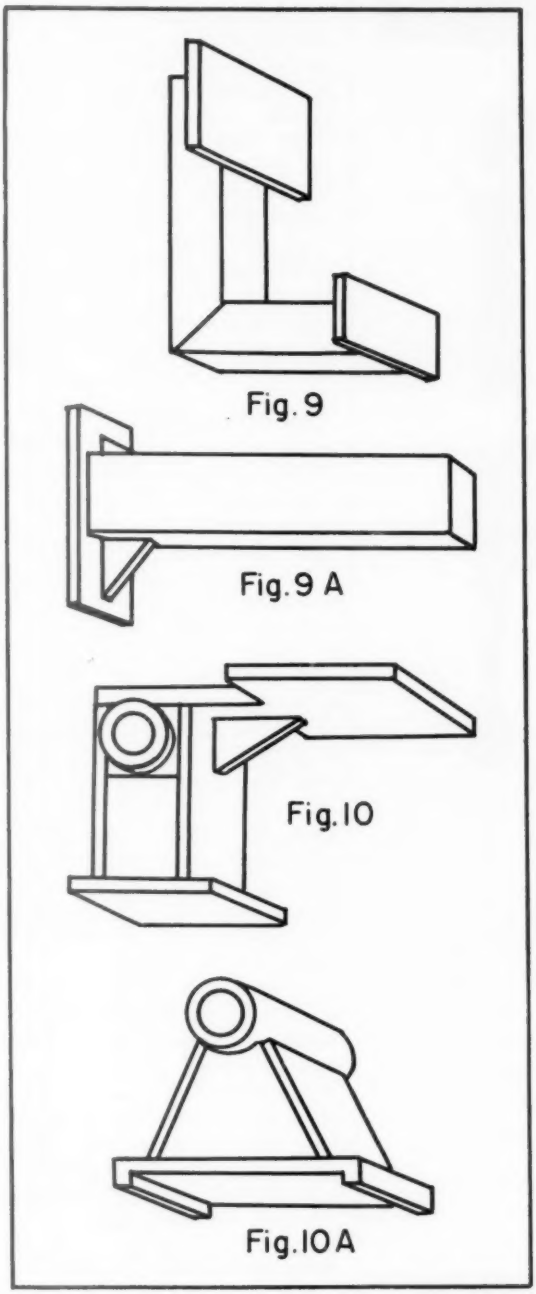
STANDARD STRUCTURAL SHAPES

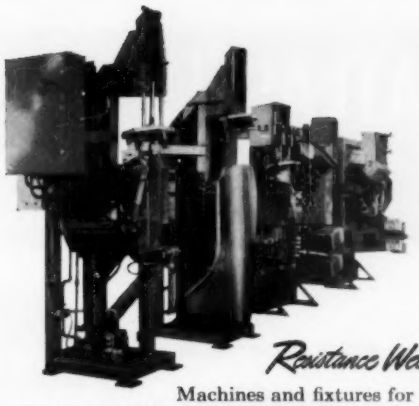
continued from page 51

Brackets and head and tail stocks can also be made from standard structural shapes. Square steel tubing or tubing made of two channels welded together is



ideal for bracket extensions (Figures 9 and 9a). Pads can be welded on for mounting to a machine base or for mounting motors, gear boxes and pillow blocks.

Two styles of head or tail stock mountings are shown in Figures 10 and 10a. These are fabricated from plate and tubing. • •



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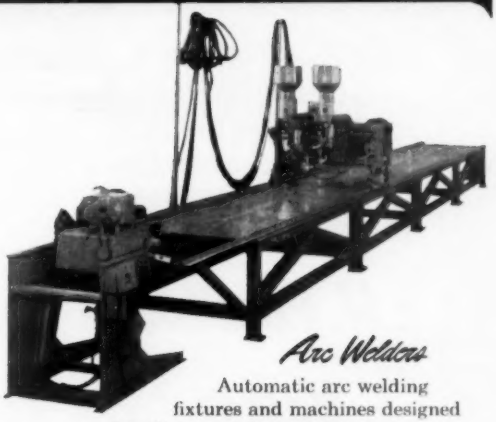

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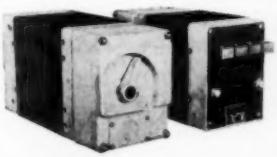

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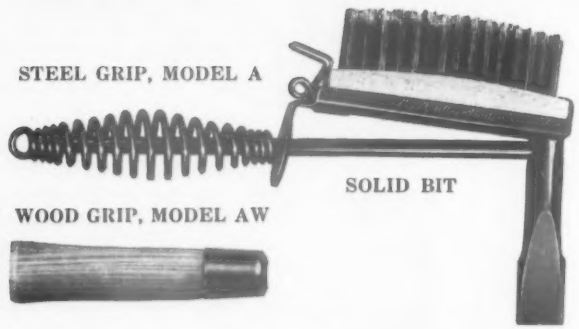

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FORD'S FALCON

continued from page 43

Ford got the gun manufacturer to make the 2-trigger gun. Main reason: they wanted a gun that could successfully weld the new zinc-coated steel.

For example, they use 1060 pounds electrode pressure at 15 cycles to weld the front side innermember of the front end structure to the front suspension strut mounting (see cutaway). Each weld button size according to quality control, must fall within these limits—0.32 inch maximum to 0.29 inch minimum diameter. To spot weld 18-gage zinc-coated steel to 14-gage mild steel, Ford uses the low pressure trigger with 625 pounds electrode pressure at 10 cycles. Button size is maximum 0.25 inch to 0.22 inch in diameter.

WELD PREPARATION

Before parts are spot welded in the fixtures the assemblers paint designated points with petroleum tar paste. It acts as a water seal and a weld conditioner. Ford also uses a rubberized sealer that expands under spot weld heat—it also acts as a water seal and a weld conditioner.

ARC WELDING

Besides spot welding, much of the assemblies and subassemblies are arc welded. Many inches of arc welds hold and strengthen critical stress areas that have been spot welded. They arc weld the areas that their spot welding guns cannot reach. The welding machines are rated at 150 to 200 amperes. All purpose electrodes ranging from 3/32-inch to 5/32-inch in diameter are used.

They use a limited amount of gas welding and brazing for tacking, welding inaccessible spots or for watertight joints.

Quality control is important. Besides process inspection, extensive tests are made. At set intervals, completed welded assemblies and subassemblies are picked at random and are tested by destruction.

BODY TAKES FORM

The body takes its final shape in the frame bucks. All the subassemblies are spot and arc welded into one shell. The shells are removed and placed on body dollies where additional parts are added and welding is finished. • •

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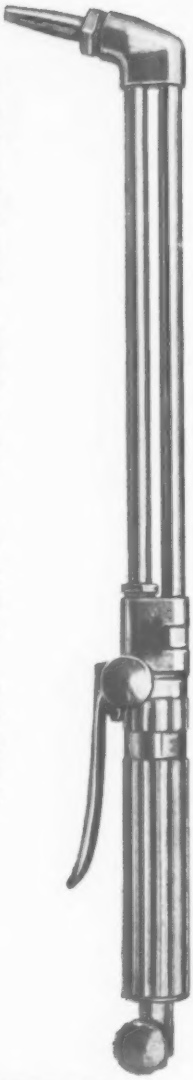

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A.W.M.A.

continued from page 22

and become machine tools, with the precision, range of motions, controlability and ruggedness expected of the various metal cutting machine tools.

Indeed, we have a valid comparison if we draw an analogy between a carbide cutting tool and an automatic welding head. Neither can perform its function until moved in a prescribed, controlled pattern in relation to the work piece. Such movement requires machinery of varying degrees of complexity and, while machine tools for cutting operations are well known, the machine tools for welding are in a stage of change, and are emerging from the earlier predecessor class of tools and fixtures.

As this trend has become apparent, a number of machine builders who have been traditionally allied with welding, have taken the lead in designing and furnishing such machines. Some large, some small in size, these builders have developed machinery which is varied and ingenious and which reflect the talent and background of the manufacturer.

But, as is the case in any new field, where there are few mileposts for guidance, there has been little coordination of similar or related machinery. There is a wide variation in the standard of quality of component parts of such machinery and a scarcity of basic technical information which, properly applied, would permit each manufacturer to offer a more rational, more adequate product to the market.

It is the purpose of A.W.M.A. to draw the technical and management personnel of these manufacturers together so that, through proper committee action, there may be an exchange of technical information. Such matters are uniform nomenclature, engineering standards, methods of rating, and classification of capacities of machinery, industry education, and an active campaign for higher functional standards; all are within the scope of A.W.M.A.'s committees if the association fulfills its obligation to the industry it serves.

Thus it is the objective of A.W.M.A. to sponsor and facilitate the growth of automatic welding by providing efficient, dependable machines to mechanize automatic welding as a flexible production method.

REFERENCE DATA

catalogs, handbooks, manuals

LIQUIDWELD REGULATORS AND TORCHES are the subject of literature and price lists available from Liquid Carbonic Division, General Dynamics Corp. Important features are described in detail and illustrated. **For More Information Circle No. 49 on Reader Service Card.**

A PORTABLE MIDGET SPOTWELDER is the subject of a 2-page brochure available from Spot Welder Division, The Merit Company. The brochure contains complete specifications and uses of the Merit Might Midget spotwelder. **For More Information Circle No. 100 on Reader Service Card.**

A GUIDE TO PREHEAT has just been published in a 28-page booklet by the J. B. Nottingham & Co. Inc. It covers the where—why and what of preheating. The booklet lists useful tables, do's and don'ts and a glossary of terms used in the field of preheating. **For More Information Circle No. 101 on Reader Service Card.**

NEW RESISTANCE WELDING CONTROLS developed by the Budd Company are described and illustrated in two separate two-color four-page bulletins. Complete specifications and operating data are given for the Monautronic V-2 and VR-3 in the bulletins. Voltage constraint and resistance drop are outstanding features of these new controls. **For More Information Circle No. 102 on Reader Service Card.**

ABRASIVE WHEEL CONSTRUCTION is discussed and illustrated in an engineering data sheet available from The Norton Company. The data sheet features wheels securely anchored to mandrels, a new development in abrasive wheel construction. **For More Information Circle No. 103 on Reader Service Card.**

AN EYE-SAFETY SPECTACLES bulletin is available from Welsh Manufacturing Co. The bulletin gives the complete story on Welsh's welders' flash spectacles: Style 2050 and 3261. The bulletin gives specifications on each type. **For More Information Circle No. 104 on Reader Service Card.**

WELDING DATA BOOK covering the selection and uses of low temperature welding alloys is available from the Eutectic Welding Alloys Corporation. This 18-page pocket data book gives technical information and welding procedures for every base metal and every welding job. **For More Information Circle No. 105 on Reader Service Card.**

LOW-TEMPERATURE SILVER BRAZING is the subject of two reference manuals from American Platinum & Silver Division, Engelhard Industries, Inc. The manuals are a complete guide to selective fluxing and successful silver brazing. **For More Information Circle No. 10 on Reader Service Card.**

REACTIVE METAL WIRE for welding, screens, filters, fasteners, cable—0.10 to 3/8"—coiled or straightened is the subject of a brochure available from Johnson & Funk, a subsidiary of Mallory Sharon Metals Corp. **For More Information Circle No. 106 on Reader Service Card.**

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These seamless fiber glass units (of therme-setting, polyester resin) are compression-molded and stoutly reinforced to afford maximum protection. All are fitted with the new Fit-Rite, snap on, ratchet type headgear—the most comfortable, durable and easiest-to-maintain you can buy, and not more expensive.

NEW DESIGN ADVANTAGES

1. Lighter weight for more comfort.
2. A smoother and stronger shell.
3. Easier cleaning and sterilizing.
4. Non-warping moisture-proof construction.
5. Superior resistance to heat.

No. 51-8F-2H

No. 53-8F-2H

No. 51-2F-2H

No. 53-2F-2H

Enjoy real savings with Flood's
1000-HOUR COVER LENS
Outlasts 125 glass lenses. Reduces eye fatigue. Safer because shatter-proof.

See Your Distributor or Write:

Flood Always FINEST QUALITY FAIRLY PRICED
FLOOD SAFETY PRODUCTS CO.
3037 WEST LAKE STREET, CHICAGO 12, ILLINOIS

HELP

STOP ACCIDENTS • CUT TIME LOSS
REDUCE INSURANCE COSTS • SAVE LIVES!

install and use NEW
MORRISON
REVOLVING CUP GUARDS
. . . on your portable tools

HELP STOP costly accidents with MORRISON Revolving Cup Guards! Safety codes and laws REQUIRE guard protection. Specify MORRISON for maximum safety . . . lighter weight . . . lower cost . . . greater strength. Full protection for operator with minimum interference with work.

Remember, MORRISON also makes standard wheel guards. There is a MORRISON Guard for every application . . . all are made to comply with American Standard Safety Code.

See your grinding wheel supplier or write:

MORRISON PRODUCTS INC. 16816 Waterloo Road, Cleveland 10, Ohio

For More Information Circle No. 55 on Reader Service Card.

TOGGLE CLAMP FEATURES are outlined in Bulletin 59-C just offered by the Wolverine Tool Co. Specifications and applications for the variety of sizes, styles and mountings available are thoroughly treated. Valuable information is given on how speedy-clamping can save considerable money.

Circle No. 83 on Reader Service Card.

HOW TO WELD T-1 Steel is the subject of a detailed 24-page booklet available from United States Steel Corporation. The booklet was compiled to guide fabricators and operators working with T-1 in both shop and field. It also contains a circular slide rule "heat input calculator" which determines correct amps, volts, and welding speeds.

Circle No. 107 on Reader Service Card.

GAS WELDING, CUTTING and allied equipment is featured in a 40-page six-section manual published by Smith Welding Equipment Corporation. The heavy-cover manual contains charts and technical data on various items. It is illustrated to show equipment in proper size relation. One section has flow capacity curves for the company's line of gas pressure regulators.

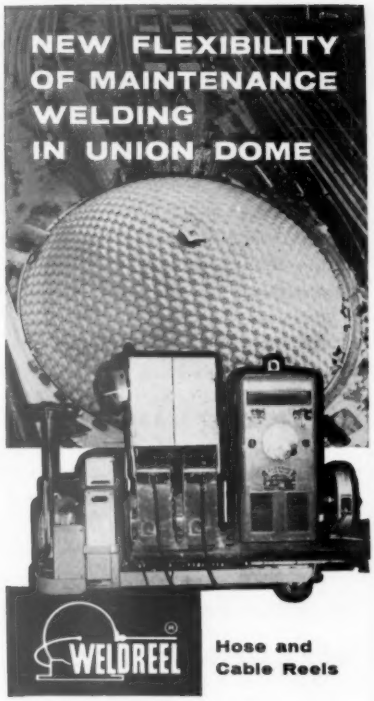
Circle No. 108 on Reader Service Card.

DATA SHEET covering new, smaller, Style 20 silicon power rectifiers designed for operation at current levels from one to 15 amperes (single phase half wave average) is available from Syntron Company. Illustrated sheet presents complete description, data and specifications for the new rectifiers. Drawings show complete dimensions for the 7/16-inch hex stud-base diodes.

Circle No. 109 on Reader Service Card.

WELDING HELMETS made of seamless fiber glass and thermosetting polyester resin are the subject of literature available from Flood Safety Products Company. Five important design advantages are given for this type of construction.

Circle No. 35 on Reader Service Card.



Hose and Cable Reels

AT UNION TANK CAR COMPANY'S new maintenance facility in Baton Rouge, Louisiana, portable welding units like this one, are easily moved right up to the job site by small lift truck. Then welding cable, ground cable and welding hose are paid out as needed from WELDREEL reels.

When a job is completed, hose and cable are quickly rewound onto reels by strong springs, and the entire unit moved to a new location. Not only does this permit maximum use of welding equipment . . . *it also extends life of hose and cable* . . . keeps it off floor when not in use . . . *increases plant safety.*

Designed to handle a wide variety of single and dual hose, and single and multiple cables, WELDREEL reels are available to a wide variety of industrial applications. Write for full information.

MODEL OA-A holds 50' of 3/16" or 40' of ¼" dual hose. Model OAB has capacity for 150' of ¼" or 125' of 5/16" hose.

MODEL EA-2 with current capacity of 300 amps holds 50' of 2/0 welding cable. Model EA has capacity of 100' cable.

MODEL A-1 has 50' capacity of ¼" or ⅜" I.D. single hose. The larger Model A-2 holds 50' of ½" hose.

UNITED SPECIALTIES INC.
POST OFFICE BOX 698 · EL DORADO, ARKANSAS

Circle No. 77 on Reader Service Card.

HOSE AND CABLE REELS designed to extend the lives of hose and cable, increase plant safety, improve housekeeping, and save time and space are described in illustrated literature from United Specialties, Inc. Construction and specifications are given for dual hose reels and cable reels.

Circle No. 77 on Reader Service Card.

INSTRUCTION MANUAL which tells how to solder stainless to aluminum, aluminum to copper and cast iron to steel is available from All-State Welding Alloys Company, Inc. Manual covers seven special solders, telling how and where to use them.

Circle No. 110 on Reader Service Card.

FREE SAMPLE and literature describing Royal hardening powder are available from Anti-Borax Compound Co., Inc. Literature tells how the powder, which comes in a shaker can, hardens low carbon steels as well as cyanides without producing toxic fumes.

Circle No. 111 on Reader Service Card.

CONDENSED CATALOG of face and eye protection products has been published by Sellstrom Manufacturing Co. Four-page illustrated Bulletin 35-F features chipping goggles, welding helmets, face shields, respirators and replacement lenses and plates.

Circle No. 112 on Reader Service Card.

HOW TO GALVANIZE with Galvalloy is explained in literature from Metalloy Products Co. The company offers to send a testing sample; literature gives instructions for the simple three-step application procedure.

Circle No. 53 on Reader Service Card.

HOW ONE DIAL sets up any air-operated spot or projection welder for any combination of materials and thicknesses is explained in literature by Thomson Electric Welder Company. Sheet tells how the "Cali-Matic" control regulates force, weld time, heat, hold time—as many as five or six variables—with one setting.

Circle No. 113 on Reader Service Card.

WELD WITH
Tipaloy

YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:
TIPS:
ROD or BAR:
SEAM WELDING WHEELS:
FORGINGS:
CASTINGS:
HOLDERS:
ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
RWMA Class #1, Tipaloy #100
RWMA Class #2, Tipaloy #130*
RWMA Class #3, Tipaloy #200
and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

Send your trial order today

***TIPALOY #130 cast and processed under our patents.**

FREE: Write for your copy of Tipaloy's comprehensive new catalog.

Distributors and Representatives: Write for complete information about available territories.

Tipaloy INC. | 1435 E. MILWAUKEE AVE. DETROIT 11, MICHIGAN

Circle No. 74 on Reader Service Card.

For More Information Circle No. 43 on Reader Service Card.

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INDEPENDENT
Acetylene Cylinders

Unconditional Guarantee
Proven Filler - No "Spitting"
No voids - No soft Spots
Seamless Cylinders for Durability
Alloy shells for Lighter Weight
Cylinder Shells - Meet all ICC Requirements
All Cylinders "WHEELABRATOR" cleaned
Standard Sizes in Stock - Special Sizes on Request

Independent also manufactures Low Pressure Acetylene Generating Plant Equipment.

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Manufacturers of
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CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · NITROGEN · ARGON
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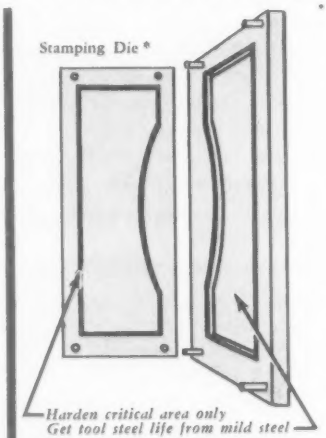
EXTRA HARDNESS Where you want it
In One Quick Operation

Carburize, Nitride and Chromize *Simultaneously* . . . easy as 1, 2, 3.

1. *Heat part (even with a torch) and apply HARD-N-TUFF powder to desired area only.*
2. *Reheat.*
3. *Quench.*

Stamping Die *



Harden critical area only
Get tool steel life from mild steel

Use HARD-N-TUFF on dies, fixtures, cutting tools. . . on any cutting edge, bearing or impact surface.

* *HARD-N-TUFF gave one manufacturer 500,000 stampings before reconditioning die.*

✓ EASY ✓ NON-TOXIC ✓ FAST ✓ ECONOMICAL

It's the surface hardness that counts!

HARD-N-TUFF

Ask your Industrial Distributor for full details or write direct to:
HARD-N-TUFF CORP.
P.O. Box 275, Huntington, L.I., N.Y.

For More Information Circle No. 37 on Reader Service Card.

USEFUL LITERATURE *continued*

SMALL PRESS BRAKES are the subject of a new 4-page bulletin issued by Dreis & Krump Manufacturing Company. Two light-duty mechanical press brake models are illustrated and described in Bulletin No. S-59. Also described are the many features and complete specifications of Model 131 (11-ton capacity) and Model 265 (25-ton capacity) press brakes.

Circle No. 114 on Reader Service Card.

VEST POCKET MARKER for marking hot, cold, dry, wet, oily, rough and smooth surfaces is described in folder from Markal Company. Capsule description of Paintstik is given. A color chart and a selection chart are included.

Circle No. 115 on Reader Service Card.

COAT, WELD AND WIPE are the three easy steps described in a folder put out by York Engineering Company, on how to use Spat-R-Pruf Compound 106. Do this, says York, and you'll eliminate spatter grinding after welding and have a good paint base too.

Circle No. 116 on Reader Service Card.

WELDING EQUIPMENT . . . for single spot or automatic resistance welding production lines . . . automatic arc welding fixtures and machines for production requirements . . . are described in illustrated literature from Goodrich Welding Equipment Corp. Capacities and specifications are given for typical installations of Goodrich equipment.

Circle No. 136 on Reader Service Card.

AUTOMATIC brazing and soldering machines are pictured and described in catalog No. 100-59 available from Eisler Engineering Co., Inc. Eighteen high production machines are shown along with examples of parts that can be joined.

Circle No. 117 on Reader Service Card.

Tough C-Clamps

Designed for maintenance-free, secure clamping are the fully heat-treated C-clamps manufactured by Wilton Tool Manufacturing Co., Inc.

Circle No. 118 on Reader Service Card.

CERAMIC WELDING SHIELDS are described and illustrated in a new, 2-color catalog available from Diamonite Products Manufacturing Company, division of U. S. Ceramic Tile Company. The catalog discusses reasons for high alumina ceramics in using welding shields. It describes physical properties, heat-resisting qualities and strength characteristics.

Circle No. 119 on Reader Service Card.

RADIATION SOURCES for irradiation research and radiography are described in a new 12-page brochure put out by Nuclear Systems Division of The Budd Company. Publication illustrates and describes Nuclear's facilities, its training courses for new customers, and its radiography sources. The various types of radioisotopes available from Nuclear are also listed.

Circle No. 120 on Reader Service Card.

"HOW TO CUT COSTS by using Alloy Mechanical Tubing", is a 4-page primer published by the Tubular Products Division of The Babcock & Wilcox Company for design and production engineers in the metalworking office equipment market. The folder discusses initial cost, structural advantages of tubing over bar stock, fabrication by machining, types of steel, types of tubes and gives procurement tips.

Circle No. 121 on Reader Service Card.

NEW ELECTRONIC PHOTOCELL tracer is described and illustrated in a 4-page color bulletin available from Linde Company, Division of Union Carbide Corporation. The bulletin describes how simple pencil line sketches of intricate shapes and forms can be used to guide oxygen shape-cutting machines with the new "Photocell" tracer.

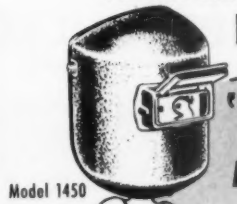
Circle No. 122 on Reader Service Card.

PRECISION MEASURING MIcrometers are described in three brochures available from Testing Machines Inc. The brochures cover their line of precision motorized and manually operated micrometers.

Circle No. 123 on Reader Service Card.

For More Information Circle No. 28 on Reader Service Card.

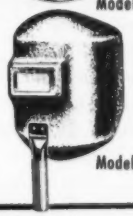
King Arthur claims:



Model 1450

"I don't jest when I joust, no foolin' Dockson HELMETS are ye best for protection and comfort."

Model 1475



Model 1225

Complete, comfortable protection against sparks, flash and dangerous rays. Light, roomy, adjustable, easy, one-hand raising. Stays where you want it.

Built to last of tough, one-piece, rivetless, moulded fibre.

Dockson CORPORATION

There's a style to suit your need. Write for catalog 56-06.

3839 Wabash Ave., Detroit 8, Mich.

NATIONAL CARBIDE
IN THE RED DRUM

HIGHEST QUALITY

DUST FREE

DEPENDABLE SUPPLY

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

GENERAL OFFICES: 150 EAST 42ND STREET, NEW YORK 17, N. Y.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

For More Information Circle No. 56 on Reader Service Card.

60 second dip removes oxide and scale from aluminum and stainless steel

Remarkable action of OX-OFF 536 **ends** costly, time wasting grinding, scratch-brushing and sanding. As simple as rinsing a glass!

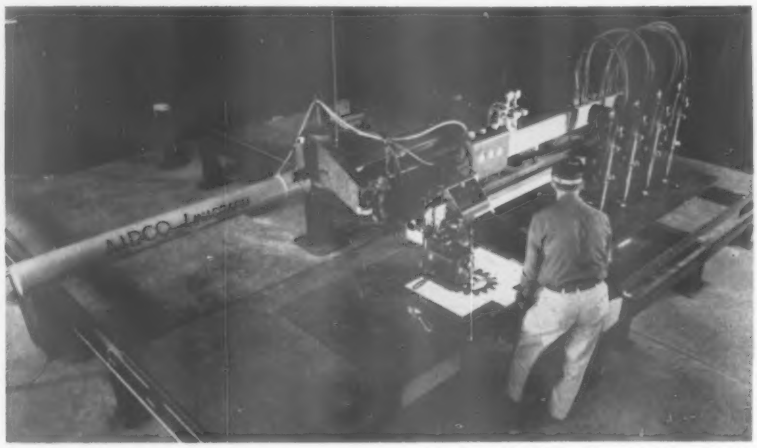
In everyday use by stainless steel and aluminum fabricators throughout the country. SPEEDS PRODUCTION for manufacturers of kitchen equipment, cooking utensils, railings, storm windows, doors, awnings, aircraft parts, watch cases, ship-fittings, and many other stainless steel and aluminum products.

Write for laboratory specifications and free technical advice.

Chemclean Products Corp.
15-08 121 St., College Pt. 56, N. Y.
MANUFACTURERS OF INDUSTRIAL CHEMICALS AND SPECIALTIES

Circle No. 23 on Reader Service Card.

NEW PRODUCTS



Eight-Foot Shape Cutting Machine

A new eight-foot cutting machine of pantograph design—the first of its kind—has been introduced by Air Reduction Sales Co.

The Linagraph is designed for medium duty shape cutting on the economical eight-foot size steel plate. Equipped to carry a maximum of four motorized torches for use with acetylene, propane or natural gas, it is capable of shape cutting and straight line cutting anywhere in a rectangle bounded by a 96-inch width and an indefinite length determined by the number of rails and tracks used. The tracing area is provided with a movable template-top eight by four feet.

The principal innovation in the new unit is its centralized operator control. All controls for gas pressure, the motorized torches, the machine carriage and the tracing devices are located directly above the mobile tracing table within easy reach of the operator. The machine is powered by an electric motor operating on 110 volts AC.

For More Information Circle No. 150 on Reader Service Card.

Adjustable Goggles

Universal-fitting, spatula-type patented Retrax temples are now available on the new Rapido line of custom-fit frames manufactured by Watchmoket Optical Co., Inc. The new temples supplement standard smooth hook Retrax temples. The wearer simply slides the spatula ear piece in or out of the temple member.

Circle No. 161 on Reader Service Card.

Straight Air Grinder

Double the air power plus new safety controls are features of the new line of 6-inch capacity air grinders introduced by Thor Power Tool Co. The new grinders will deliver more torque to the wheel and remove more metal faster with less exhaust noise.

The grinders are available with butterfly, lever and grip throttles and are available with 4,500 or 6,000 rpm speeds. Special gearing sets wire brush model speeds at 2,000 rpm.

Circle No. 162 on Reader Service Card.

FACTS AT YOUR FINGERTIPS: *Do you want full information on the latest welding products shown on these pages? Just circle the appropriate number on the bound-in readers service card and you'll get it.*

Engine-Driven Welder

Welding voltage is adjusted automatically during use of new 300 and 400 amp DC diesel engine-driven welders introduced by A. O. Smith Corp. Only two indicators have to be set to operate either unit: one for electrode size, the other for desired current.

The self-contained welders feature current curves that remain steady at extreme ends of range. Flattening out of peaks allows deep penetration without burnthrough.

A convenient outlet is provided for the operation of universal tools and floodlights.

Circle No. 153 on Reader Service Card.

Single-Stage Regulator

A low-cost, single-stage regulator that is said to match or even exceed the performance of higher priced regulators has been introduced by Harris Calorific Co. The Model X25 will pass 2,000 cfh, enough to cut 14-inch steel, with only 2 pounds drop from no flow to flow.

Unique, soft valve seats eliminate seat leak or creep. Large Diaphragm area (2¾-inches) assure accurate pressure regulation.

The Model 25 regulator is furnished for oxygen, acetylene, propane and other common gases.

Circle No. 154 on Reader Service Card.

Hardfacing Electrodes

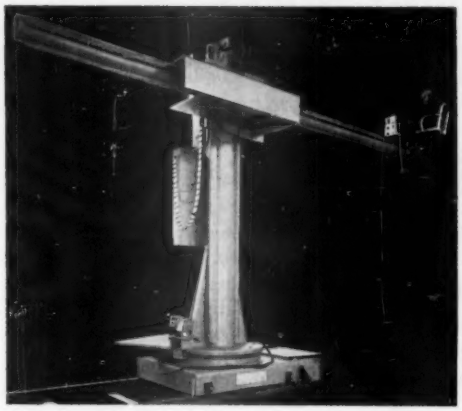
A new manual, tubed electrode for general purpose hardfacing applications is available from American Manganese Steel Division of American Brake Shoe Co. The easy-to-handle new rod features a stable, low-spatter arc with smooth running speeds and excellent buildup. It is alloyed for use where impact and abrasion are a problem.

Circle No. 155 on Reader Service Card.

For More Information Circle No. 40 on Reader Service Card.

BMABB-AHIBT

(see translation below)



- **Precision**
- **Ruggedness**
- **Flexibility**
- **Long Life**
- **Electronic Drive**
- **Minimum Deflection**
- **Flame Hardened V-Ways**
- **Double Chain Lift**
- **Dynamic Braking**
- **Complete Automation**

Welding Head Manipulator, CB 15 x 20 (above) provides motorized vertical adjustment of 15′ (3′ to 18′), 20′ variable speed ram travel and motorized 360° rotation. Heavy duty carriage carries Manipulator, Generators and Flux Recovery Equipment. All Manipulator and Welding Controls in light weight pendant. Operator sits at working end of ram.

Better Manipulators Are Being Built And Herrick Is Building Them

WRITE FOR NEW PORTFOLIO

C. B. HERRICK MFG. CORP.

2000 CENTER STREET • CLEVELAND 13, OHIO

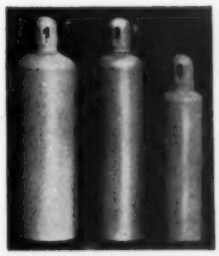
WITH CONTINUED INFLATION AHEAD...

now is the time to invest in the future

PROTECT YOURSELF AGAINST TOMORROW'S HIGHER PRICES by investing *TODAY* in COYNE ACETYLENE CYLINDERS.

Take advantage of today's *lowest* price on COYNE CYLINDERS—and enjoy the reward of a capital investment that appreciates in value over the years.

NOW, is the time to write, or phone (collect) for information on the COYNE all new "92" Acetylene Cylinder.



92% high porosity filler—highest rating in the industry. Stronger steel shell offers virtually "lifetime" service. COYNE ACETYLENE CYLINDERS have greater gas capacity, are faster-selling, and stronger than ordinary cylinders, yet cost no more.

COYNE *cylinder company*

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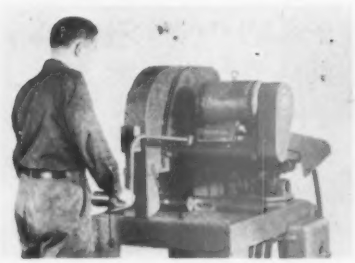
3800 Springdale Avenue, Glenview, Illinois • PArk 4-3828
24 Commerce Street, Newark, New Jersey • Mitchell 2-1618

For More Information Circle No. 26 on Reader Service Card.



Oscillating Dry-Abrasive Cutting Machine

A new, large capacity dry-abrasive cutting machine, the Model 2-A Sever-All, has been introduced by the Allison-Campbell Division, American Chain & Cable Co., Inc. The machine is designed for heavy-duty work in metal working plants. It can cut practically all metals up to 4-inch solids, rounds or squares; 5½-inch OD pipe or tubing; 6- by 1-inch flat stock; 6-inch angle iron and 8-inch channels.

Optional work-holding arrangements include vise-type holders for making 90° cuts and an adaptor unit for cutting right hand or left hand angles from 90° to 45°.

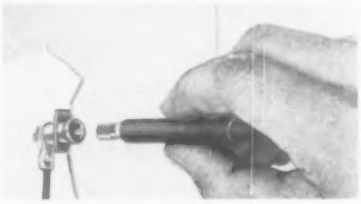
With an abrasive cutting wheel (20- by ⅛- by 1-inch), the machine cuts one square inch of metal in two to three seconds.

Circle No. 5 on Reader Service Card.

Plastic Cover Lens

The Thermacote Company announces a new lens being sold under the "Sta-Kleer" tradename. The company says this new product will give up to 40 percent more life with no increase in cost. Samples and literature are available.

Circle No. 72 on Reader Service Card.



Panel Receptacle

Designed for rapid assembly into any electrical panel and for fast wire connecting and disconnecting, a new receptacle with mating plug has been developed by Cam-Lock Division of Empire Products, Inc. The Model WA-014 receptacle can be panel-mounted in seconds without special tools. Only ⅞-inch long, it is knurled to prevent rotation when pressed into a panel or insulating strip. It is further locked in place with a speed nut.

Circle No. 157 on Reader Service Card.

Safety Hats And Caps

Superglas safety hats and caps manufactured by the Fibre-Metal Products Company are said to have improved safety, weathering and abrasion-resistant characteristics.

HOW TO SAVE TIME and MONEY ON YOUR PIPE FABRICATION WORK

Put this "one-man pipe shop" to work in your plant

Produces straight or beveled cut-offs, saddle and insert type tee intersections, lateral intersections and miters. Extremely simple to operate. Pipe is laid on rollers. The horizontal reciprocating movement of the cutting torch is automatically guided and synchronized with the rotation of the pipe to produce the contour of the cut desired. Used by oil refineries, constructors, pipe fabricators, aircraft companies, tank manufacturers, etc.

SOME OUTSTANDING PANTOGRAPH FEATURES and ADVANTAGES

- Handles any length pipe.
- No chucking required.
- No layout or templates required.
- No hand trimming—cuts are smoothly finished and beveled.
- Makes uniform cuts on production runs.
- Two models available—Model C (shown)—handles pipe from 2" to 24" diam. Model G for pipe up to 42" O.D.

WRITE FOR BULLETIN NO. P-10

VERNON TOOL CO., LTD., 1101 MERIDIAN AVE., ALHAMBRA, CALIFORNIA

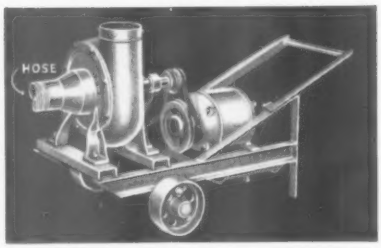
VERNON "PIPE-CUTTING" PANTOGRAPH

For More Information Circle No. 78 on Reader Service Card.

RUEMELIN *Portable*

Fume Collector

Removes gas, smoke and heat from welding operations. Recommended for ventilation of tank interiors, manholes, vats, airplane fuselages or for blowing fresh air into inaccessible places.



• Collector is equipped with a power unit capable of handling up to 35 ft. of steel tubing. Mounted on rubber tired wheels for ease of handling. Models also available mounted on steel legs for hose operation in a complete 360 degree circle.

• This view shows inlet hood picking up welding smoke. Operator breathing zone protected.

WRITE FOR DETAILED INFORMATION.

RUEMELIN MFG. CO.

3891 N. Palmer St., Milwaukee 12, Wis. U.S.A.

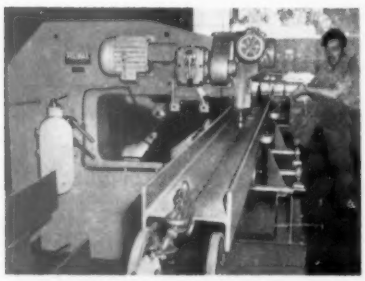
Manufacturers and Engineers • Sand Blast and Dust Collecting Equipment • Welding Fume Collectors

Circle No. 60 on Reader Service Card.

One safety feature is a single-piece, molded polyethylene suspension unit with 1¼-inch crown clearance and an adjustable clearance laced to fit each user. Suspension is soft and pliable for comfort, rugged for safety and designed to stay clean and be cleaned easily.

Important are spun glass fibres placed near the shell's outer surface. This results in a thin layer of resin and glass fibers near the surface. This increases the shell's life, makes colors last longer and makes the surface more resistant to weathering and abrasion.

Circle No. 34 on Reader Service Card.



Beam Splitting Machine

A beam splitting machine introduced by American Pullmax Company is called the Pullmax U-10. This heavy-duty machine has a new automatic, push-button control mechanism for starting, penetrating and cutting heavy metals. In regular operation I-beams can be pulled through the machine at the rate of 10 to 20 ipm. Edges are smooth and finished and beams are not distorted.

The machine can also be used for circle cutting, straight shearing and other cutting and forming operations.

Circle No. 159 on Reader Service Card.

Safety Glasses

Safety glasses with a bridge design that fits 95 percent of all faces has been announced by Willson Products Division, Ray-O-Vac Co. The bridge was developed to limit inventories and to eliminate the need for trained fitters.

Nose pads and the bridge of the glasses provide continuous bearing support for maximum comfort. Two lens sizes provide wide vision and effective protection. Glasses have either plastic-cable temples, metal or spatula temples.

Circle No. 160 on Reader Service Card.

For More Information Circle No. 72 on Reader Service Card.

THERMO is FIRST Again with a Revolutionary Sta-Kleer All-Plastic Cover Lens

Never Before Available for Use in Welder's Helmets

40% MORE LIFE

LABORATORY TESTS PROVE WHY . .

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✓ 40% MORE Resistance to Molten Slag

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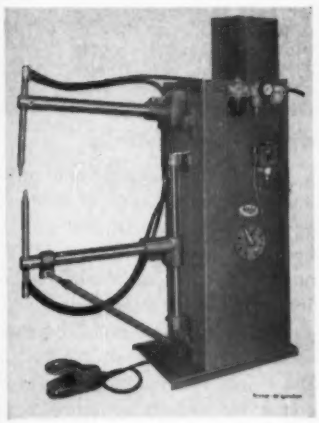

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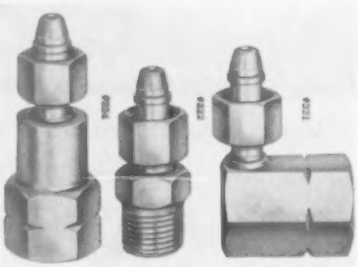

New Adaptors For Acetylene Regulators

Manufacturers of brass fittings for the welding trade, Western Enterprises, Inc., has introduced three new additions to their adaptor line.

Adaptor #321 adapts "MC" tank to P.O.L. acetylene regulator; #322 adapts "MC" tank to commercial acetylene regulator; #324 adapts "MC" tanks to P.O.L. acetylene regulator.

Circle No. 161 on Reader Service Card.

Safety Face Shield

A safety face shield combining vision with ventilation has been developed by American Optical Co. Designed for these two purposes, the company's Kool-Vent shield has an optically correct acetate window in an 8- by 11-inch fine metal 24 mesh screen.

The shield is held securely before the face by adjustable fibre headbands. This permits wearing regular prescription glasses. Acetate windows are available in clear, green or aluminized.

Circle No. 162 on Reader Service Card.

Flow Meter Regulators For Inert Gases

New flow meter regulators developed by Smith Welding Equipment Co. are said to reduce the amount of argon and helium used in shielded inert gas welding by measuring them accurately. Secret of the flow meter's accuracy lies in the extra long meter tube and a unique center guide for the ball float. The six-inch tube provides greater sensitivity and permits more accurate readings. The float guide eliminates "bouncing" of the measuring device.

The regulator is said to hold constant pressure settings from full cylinder to 50-75 pounds inlet pressure, The first stage pressure setting is 100 psig; the second stage (to the flow meter) is preset at 30 psig.

Flow range for the argon meter is 60 scfh; for the helium meter is is 200 scfh.

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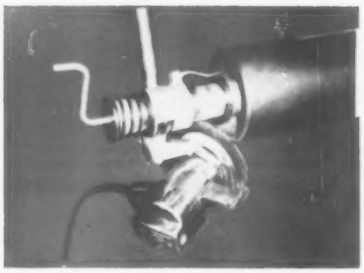

Bevel-Land Grinder

Development of an electric motor-driven grinding machine for smoothing and putting lands on bevels automatically has been introduced by H & M Pipe Beveling Machine Co. Called Bevel-Land Grinder, the new machine eliminates time-consuming filing, hammering and hand grinding.

Two models are available. They will handle pipe 6- through 36-inches in diameter. The machine is light, portable and is locked in place inside the pipe in seconds.

Circle No. 164 on Reader Service Card.

Welder Power Unit

A new gasoline engine-driven combination arc welder and power unit designed for tungsten-inert-gas-shielded arc welding in the field has been announced by Hobart Brothers Co.

The unit has one engine and one generator. It provides either AC or DC welding current. It is rated 250 amps, 30 volts for DC and 300 amps, 30 volts for AC; both ratings are on 100 per cent duty cycle.

The unit will also provide single phase AC power of 10 KW capacity.

Circle No. 165 on Reader Service Card.

Portable Screen

This new "Foursome" screen is a four-sided portable unit developed by Singer Glove Mfg. Co. It is constructed of one-inch tubular steel with durable rust-proof black oxide finish. It has slip-joint construction for easy assembly. Extremely light, the screen weighs only 85 pounds. It folds for storage or moving. Heavy duty casters are available.

Circle No. 166 on Reader Service Card.

Economy Manipulator

A new, low-priced ram-type manipulator developed by C. B. Herrick Mfg. Corp. has many features of heavy-duty machines. The rugged unit provides 6-feet of actual vertical travel, motorized with magnetic braking, 8-feet of ram travel featuring an electronic variable speed drive (5 to 100 ipm) and 360° manual rotation with positive lock.

The CB 6x8 MD is available in either stationary or carriage-driven models. Precision track is provided in 20-foot lengths and carriage travel may be constant or variable speed for welding. Complete push-button control of all movements and speeds is in small portable pendant. Welding control plus speed indicators may be incorporated in this unit.

Circle No. 167 on Reader Service Card.

For More Information Circle No. 59 on Reader Service Card.

Pictured — Semi-trailer mounted 2,000 gallon Cryotainer used to supply liquid to a cylinder charging system through a high pressure liquid oxygen pump.

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Improves Quality . . . Cuts Costs!

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THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

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Shear only $495.00
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MINERAL WELLS, TEXAS

Circle No. 15 on Reader Service Card.

Metallizing Gun

The development of a heavy-duty, light weight, automatic metallizing gun has been announced by the Spra-Rod Corp. The new gun features a two-position air cap that adjusts itself automatically for easy lighting and fast, fine grain spraying.

It is designed to handle all wire sizes from 15 B&S gauge to 3/16-inch and will work with all metals from molybdenum to lead. A dual range air motor makes possible a wire feed range of 1.32- to 23.1-feet per minute.

The gun weighs a little over four pounds and consumes about 21 cubic feet of air a minute.

Circle No. 169 on Reader Service Card.

Tungsten Electrodes

Sparkel-X electrodes developed by Saturn Metallurgical Industries for spark machining and joining hard-to-weld metal features excellent resistance against spark erosion. The tungsten alloy electrodes are 13-¾-inches long and are available in round and square sections. Rounds range from 5/32- to 25/32-inch diameters. Squares range in size from 19/32- to 1-13/16-inches. Electrodes have flat, round or offset tips.

Circle No. 170 on Reader Service Card.

Seam Welder

A new precision seam welding machine capable of handling materials from .001- up to .01-inch thick is now available from Vacuum Tube Products, a division of Hughes Aircraft Co. With the new VTW 500, an operator can seam weld two foils together and then, by throwing a switch, can weld materials more than 10 times as thick. The secret of the welder's versatility is a phase shift heat control circuit that is adjustable to extremely low heat settings for delicate materials and still operates with stability at full power output (2.8 KVA) on a continuous duty cycle.

A variation (Model VTM 501) has an additional timing control for spot welds timed from 2 to 20 cycles. With this timing control, it is possible to make full cycle spot welds for maximum weld power of half cycle welds for delicate work. Thickness range of the VTM 501 is .0005- to .035-inches.

Circle No. 171 on Reader Service Card.

LP Gas Salamander

Wemco Products has introduced their new Model 200 LP gas salamanger. This model features a furnace-type burner with double primary injection for greater heat output and fuel economy. An automatic safety shut off has a pilot burner for greater safety and a throttling valve for heat adjustment.

Circle No. 172 on Reader Service Card.

Is Iron Powder Welding Causing Your Present Holder To Overheat?

Duro's New Durogon Heavy Duty is the answer. Heavy Bronze Construction with replaceable jaw plates, it is the holder you should be using for this type of welding.

Lots of 1-11 .....$7.15 each
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Send your order today for a sample for trial and name of your nearest distributor.

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Heat welded seam on galvanized sheet to 600° with Torch

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ARE YOU SLOWLY GOING NUTS...?

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If you're harassed by surface resistance (cleanliness) measuring problems, or want a quick way of tracking down abnormal resistances in welder current paths, then the Dice Microhm Meter is for you!

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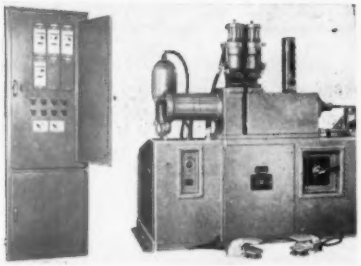

Resistance Welders

A new line of single-phase welders has been introduced by Universal Electroweld Division, Electric Arc, Inc. It is said that these new machines will produce high quality welds fast in every type of weldable metals.

The newest machine is a Model BHA butt welder (shown). This machine is rated at 5 to 100 KVA. It features horizontal pulling rams of lightweight aluminum operating in lineal ball-bearing sleeves. Ram performance is said to be uninhibited. "Heat Vector" control is said to give three-phases performance.

Other machines in the line are bench, spot projection and rocker arm welders.

Circle No. 173 on Reader Service Card.

WELDED PLASTIC CAR BODY

continued from page 44

loads and stresses met by a real, full-sized car. A one-ounce weight deflects the plastic the way a 35-pound weight would deflect a real car. Therefore, Dodge has a convenient method of testing the effect of static loads, such as passengers and baggage, and momentary loads, such as driving over curbs and rough roads.

However, the plastic of the scale model reacts differently from steel in one important way. Although its deflection is proportional to steel, it has a much greater elastic limit. You can load and deflect it *past* the point where the steel would have failed or taken a permanent set. The plastic, however, springs back undamaged when you remove the load.

The plastic model makes it possible to make non-destructive tests where once destructive tests were the rule. For instance, they have to find out whether the trunk compartment floor pan is strong enough to carry the load an owner puts into the trunk. They used to pile weights in the trunk of an actual body until the floorpan buckled or tore loose. Now, they put scale weights in the plastic model and inspect the floor visually. • •

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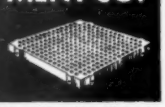

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- Being Precision made and shatterproof they last longer and insure against eye strain.
- For over 15 years THERMO has led in sales and usage.

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THERMACOTE COMPANY
108 So. DeLacey Street, Pasadena, California

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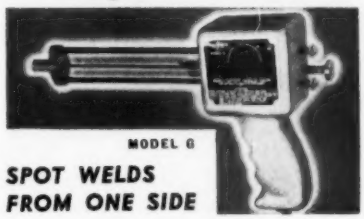

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- Welds from one side without back-up electrode
- Precision-made for long, trouble-free use
- No electronic tubes in time control
- Requires no warmup period
- No welding experience needed
- Supplied with extra-small nose piece for narrow places
- Recommended for use with BREN/WELD Power Supply or BREN/WELD Arc Welder
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Manufacturers of Welding Equipment
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AC-DC AMMETER

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BRAZE WELDING adds strength, helps prevent squeaks, leaks, and rattles in Rambler's all-welded, single-unit construction of body and frame.

Extension side roof and roof panel on a Rambler Cross Country station wagon being joined by oxyacetylene braze welding with Anaconda-997 (Low Fuming) Bronze Rod. Braze weld between rear quarter pillar and side roof rail (to left) is one of several made primarily to prevent water leakage. American Motors welding engineers have found braze welding with Anaconda-997 (Low Fuming) Bronze Rod to be an efficient and economical production tool. The alloy bonds to steel easily. The relatively low application temperature minimizes distortion and makes it easy to control weld metal. Welding operations on a moving assembly line are fast, and finishing time is reduced. The rod's low fuming characteristics make normal ventilation facilities adequate.

There are up to 30 areas, depending on the model, where braze welding is used to augment electric welding to give American Motors Ramblers an all-welded, single-unit construction of body and frame with high strength, safety, and quiet operation. American Motors claims for this construction elimination of squeaks and rattles, also better utilization of space and greater durability.

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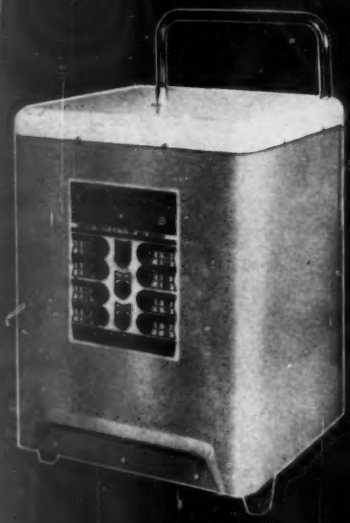

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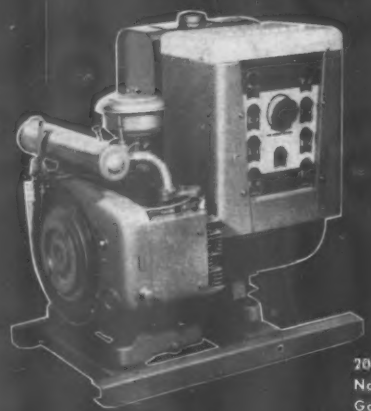

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